ANNALS of the
Association of American Geographers

Volume XLII SEPTEMBER, 1952 Number 3

TOWARD A FURTHER UNDERSTANDING OF THE REGIONAL CONCEPT*

PRESTON E. JAMES
Syracuse University

THE regional concept constitutes the core of geography. This concept holds that the face of the earth can be marked off into areas of distinctive character; and that the complex patterns and associations of phenomena in particular places possess a legible meaning as an ensemble, which, added to the meanings derived from a study of all the parts and processes separately, provides additional perspective and additional depth of understanding. This focus of attention on particular places for the purpose of seeking a more complete understanding of the face of the earth has been the continuous, unbroken theme of geographic study through the ages.

These assertions, however, will not stand unchallenged. Geographers, as well as scholars in other disciplines, do not agree on the content of the regional concept; attaching a variety of meanings to these words, they reach various conclusions. For the sake of clarity we need to distinguish differences of vocabulary from differences of a more fundamental nature.

The purpose of this paper is to seek a further understanding of the regional concept. In a sense this is an essay in geographical semantics, for it discusses the meaning of the symbols geographers use to refer to the objects and concepts with which they deal. Logic, as defined by Aristotle, holds that the definition of a word should 1) place the thing referred to by the word in a class, and 2) tell how it is distinguished from other things in the same class. In accordance with Aristotelian logic a region may be defined as "an area on the earth's surface homogeneous with respect to announced criteria." Modern semantics, however, suggests that further clarity can be had only by defining a symbol, like the word region, in terms of operations; that is, in terms of what must be done to identify and describe it, or having described it, to make use of it or to show its significance.[1]

* Presidential address, delivered at the 48th annual meeting of the Association of American Geographers, Washington D.C., August 7, 1952. The writer is indebted for many suggestions and criticisms to Derwent Whittlesey, Lester E. Klimm, Clarence F. Jones, and Clyde Kohn, and to his colleagues at Syracuse University.

[1] Anatol Rapoport, "What Is Semantics?" *American Scientist*, XL (1952): 123–135.

This approach is not new. Geographers have been formulating operational definitions for many years, long before Korzybski developed his ideas on semantics. Many of the forty-one volumes of the *Annals* that precede the current one contain essays on operational definitions.[2] The often repeated remark that "geography is what geographers do" points clearly toward an operation as opposed to a logical definition. It is important, however, that most of the geographers who have tried to define a region in terms of what they did about it were experienced field men.

The present writer is well aware that most of what he would like to say about the regional concept has already been said, not once, but many times. He is also aware that many writers from Bucher to Kimble[3] have attacked something which they described by the words, regional concept. Yet because this concept, as the writer understands it, provides the frame of reference around which all geographic study is organized, he accepts the responsibility, inherent in the presidency of the Association, of formulating his own understanding of the matter, and of attempting a more exact definition of the referents for which his symbols stand.

The best place for geographers to communicate to each other the meaning of their word and map symbols is out-of-doors in the presence of the things they are discussing. Many professional differences would be resolved and many controversies avoided if we could always talk geography in the field where we could observe directly the things and relationships that we are all trying to understand more clearly. When geographers talk or write about geography indoors they are restricted wholly to symbols; when geography is taught in the classroom it must be presented entirely by devices which impress the eye or the ear and which stand for the objective reality that lies outside. There ought to be much more discussion of what these symbols mean; and the meanings attached to the symbols by one generation should be carefully scrutinized by the next; not indoors, but always in the field where direct observation is possible.

At the moment, however, we cannot go into the field together. We are forced to attempt to communicate our ideas through the careful definition of our symbols both by the methods of logic and by the description of operations. The writer will attempt to state in logical terms what he means by the regional concept; and then he will proceed to a discussion of what he would do to identify a region, and what he would do with it after it has been defined.

[2] See especially the many writings of William Morris Davis in which he discussed the methods of doing and writing geography. For example: "An Inductive Study of the Content of Geography," (Presidential Address at the second meeting of the A.A.G., 1905), published in the *Bulletin of the American Geographical Society,* XXXVIII (1906) : 67–84; "The Colorado Front Range, A Study in Physiographic Presentation," *Annals of the Association of American Geographers,* I (1911) : 21–83; and "The Principles of Geographic Description," *Annals of the Association of American Geographers,* V (1915) : 61–105.

[3] August L. Bucher, *Von den Hindernissen welche der Einführung eines besseren Ganges beym Vortrage der Erdkunde auf Schulen im Wege Stehen,* Cöslin, 1827; George H. T. Kimble, "The Inadequacy of the Regional Concept," in L. Dudley Stamp and S. W. Wooldridge, *London Essays in Geography,* Cambridge (Mass.), 1951, pp. 151–174.

THE LOGIC OF THE REGIONAL CONCEPT

We can all agree that geography deals with the face of the earth. We assume this to refer to a zone which has not only length and breadth, but also height and depth. There need be no attempt to establish the limits of what we mean by the face of the earth, for each geographer would certainly extend his observations as far down into the earth or as far up into the atmosphere or beyond as the nature of his problems or the degree of his competence made proper.

The things geographers deal with on the face of the earth are not uniformly distributed over it. As Hartshorne points out geographers have long selected for study those things which are not uniformly distributed and have rejected as lacking geographical interest those things which are uniformly distributed.[4] There are things which are present in some places, absent from others; or which vary in intensity or motion from place to place. They may be referred to as phenomena which result from the operation of processes. A process, as we understand the term, refers to a sequence of changes systematically related as in a chain of cause and effect. A phenomenon is an observable fact or event which represents the embodiment at any one time of the intellectually-conceived sequence we describe as a process. A geographical phenomenon is any fact or event not uniformly distributed over the face of the earth.

The phenomena which are irregularly distributed over the earth are also irregularly associated with other phenomena in particular parts of the earth. Those phenomena which are systematically related because they are produced by one kind of process are associated on the face of the earth with other phenomena produced by quite different processes. This is what William Morris Davis means when he writes of "natural but unsystematic groupings."[5] The phenomena associated in a particular place are unsystematically related because they are produced by different processes.

But the geographer cannot wholly isolate one process from other processes operating in the same area. Each kind of process can be made the object of specialized study, and such specialists develop their own kinds of methods and their own instruments in order to measure and describe more precisely the sequence of changes in which they are interested. Some kinds of processes can be isolated in the laboratory, where controlled experiments are devised to eliminate all irregularities or modifications of the sequence introduced by outside influences. Other kinds of processes, notably those related to human behavior, cannot so easily be isolated in a laboratory; these are isolated symbolically by the use of such a phrase as "other things being equal." To a geographer, however, other things never are equal, for his particular mission is to study each process as it operates in particular places, and as it is actually modified in its action by the presence of other unsystematically re-

[4] Richard Hartshorne, "The Nature of Geography, A Critical Survey of Current Thought in the Light of the Past," *Annals of the Association of American Geographers*, XXIX (1939): 173-658; ref. Chapter VIII.

[5] William Morris Davis, "The Principles of Geographic Description," *loc. cit.*, p. 62.

lated phenomena grouped naturally together on the face of the earth. This does not imply that an individual geographer may not be a topical specialist, that is one who achieves special competence in the study of phenomena systematically related to a process or to a closely related group of processes. But the topical specialist in geography can be distinguished from scholars in neighboring disciplines because of the focus of his interest on the differences developed from place to place on the earth by a process rather than on the process itself. This is, of course, a hair-breadth distinction and one of small importance to an individual who is pursuing the factors of a problem back and forth from study of process to study of the differentiated face of the earth. It should never be used to set up a barrier. But it should be kept as a signpost, for the methods of studying a process as it works in an isolated system and the methods of studying a process as a part of the total association in a particular place are quite different.

Geography is not logically defined by the phenomena with which it deals. It deals with any phenomenon, material or immaterial, natural or human, that is not uniformly distributed over the earth. The distinguishing characteristic of geography is its attention to particular places. A geographer seeks to understand the causes and consequences of likenesses and differences between places on the face of the earth. He recognizes that particular places are given distinctive character by the unsystematically associated phenomena that exist in them; he seeks to define likenesses and differences between places, and to see more clearly the meaning of the relative location of one thing with reference to another. Scholars who are identified professionally as geographers are not the only ones who make use of geographic concepts or apply geographic methods. Anthropologists, economists, sociologists, and many others also study processes where other things are not equal, where the process operates as a part of the total association of processes and phenomena in a particular place. Workers in the several social science disciplines do not hesitate to make historical studies or to apply historical methods; they should be encouraged to make similar use of geographic methods, and to do so with a similar degree of expertness. When a social scientist is faced with a problem involving area differentiation he should be expected to make use of accepted geographic techniques, and if he fails to do this, it becomes the responsibility of professional geographers to point out the deficiency.

Obviously no one person could embrace the whole field of geography, any more than one person could embrace the whole of the field of history. A geographer must become especially competent in some restricted part of the field: in the study of a selected group of related processes as they operate in a few specific parts of the world. As Ackerman recognizes,[6] the geographer must specialize both topically and regionally, or topically within regions. He cannot possibly develop a real competence in the study of all possible processes that are at work in even a restricted

[6] Edward A. Ackerman, "Geographic Training, Wartime Research, and Immediate Professional Objectives," *Annals of the Association of American Geographers,* XXXV (1945): 121–143.

part of the earth, nor can he possibly understand all the modifications imposed, in all parts of the world, on those processes in the study of which he is competent. Topical and regional specialization are not separable. It does seem true, however, that knowledge of process is more important than knowledge of place for persons working at the extreme physical end of geography, especially in climatology; whereas knowledge of place is more important than knowledge of process at the opposite end where human behavior is involved.

Likenesses and Differences on the Earth

It is important to understand that no two spots on the face of the earth are identical. Yet one does not have to receive professional training in geography to perceive that there are areas on the earth throughout which a more or less homogeneous association of characteristics exists. The sense of regional uniformities is what we call regionality; regionality is a part of the lay vocabulary and is reflected in many aspects of life,[7] even where a sophisticated definition of boundaries cannot be achieved.

There are, then, areas on the earth which are homogeneous with respect to this or that phenomenon or combination of phenomena. But even the smallest of these homogeneous areas could be subdivided. There is no such thing as a "unit area," an indivisible entity completely uniform in character. Nevertheless, if we are to bring the complexity of the face of the earth into manageable units for the purpose of examining the causes and consequences of area differentiations, it is obviously not possible to examine each minute point separately. The anthropologist defines general classes into which the diverse individuals of a society are grouped; the historian defines certain spans of years as periods each with certain distinctive characteristics; the geologist defines categories of rock in each of which a certain range of characteristics is permitted: this is the method of all science—to define categories in terms of selected criteria.

The Region as a Geographic Generalization

The region is a geographic generalization. A generalization of the characteristics of area is accomplished by defining categories of area difference in terms of selected criteria. The criteria which are selected must be in terms of a stated objective or problem. For the purposes of a specific problem, it is possible to define and identify areas which are homogeneous in terms of relevant criteria, disregarding, as all generalizations do, conditions which are not homogeneous but which are considered to be irrelevant. A homogeneous area, so defined by announced criteria, must be evaluated, as all generalizations are evaluated, in terms of the purpose for which they are made. A system of regional differences is justified if it illuminates the factors or elements of a problem: it is not justified if it obscures the factors of a problem. Such a generalization of area is based on a selection of parts of a whole for the purpose of clarifying our understanding of a situation which otherwise would

[7] Merrill Jensen, ed., *Regionalism in America*, Madison, 1951.

remain less clearly understood. Whether, or to what degree, it accomplishes this purpose must be the basis of judgment or critical appraisal. There can be no such thing as a correct system of regions, or a system of "true regions;" no one system of regions is right and all others, wrong: there are as many regional systems as there are problems worth studying.

When a geographer proposes a system of regional divisions to be used in the study of a problem, he is in fact proposing a hypothesis. The regional generalization in geography is the counterpart of a general description of a process, as it is conceived to operate in an isolated system, by workers who are specializing in the study of this process. A process is first given a generalized description as a working hypothesis, and thereafter this generalized description being confronted with evidence, is either proved valuable in understanding the process, or is discarded as inadequate for this purpose. In geographical study, the preliminary system of regional divisions is hypothetical; but after being confronted with evidence, after a successful demonstration of the validity of the system of area divisions, the regional system is advanced from the status of a hypothesis to that of a theory or concept. A system of demonstrated regional divisions provides the theoretical basis, or the conceptual framework, for geographic study.

THE FACE OF THE EARTH

The face of the earth is made up of many overlapping parts. Sten de Geer recognized this when he wrote of the superimposed spheres: the atmosphere, the lithosphere, the hydrosphere, the biosphere, and the anthroposphere.[8] The complexity of the problem becomes more apparent when we realize that these various spheres are each produced by a special group of processes, that each kind of process is measured by methods different from those used in the measurement of other processes, that each kind of a sequence of change is proceeding at a different rate from that of all the others, and that each group of processes results in a different kind of area differentiation.

Static and Kinetic

Areas can be differentiated on the basis of two kinds of conditions. There are the static conditions, the patterns and associations of phenomena which at any one moment of time are fixed and immobile. Static conditions have most commonly been used in the definition of regional systems. It is also possible to define area differences on the basis of the pattern of movement at any one period of time, and these might be designated as kinetic regions. Kinetic regions might be based on such phenomena as traffic flow, commuter movement, or tourist travel.

Lines, Points, Areas, and Volumes

The phenomena which produce likenesses and differences between places on the face of the earth, whether static or kinetic, form four different kinds of patterns.

[8] Sten de Geer, "On the Definition, Method, and Classification of Geography," *Geografiska Annaler* (1923): 1–37.

There are patterns of lines, patterns of points, patterns of areas, and patterns of volumes. Because of the importance of the map as a device for the analysis and presentation of geographic phenomena, these different kinds of patterns are commonly shown as areas, with lines forming the underlying base data. Nevertheless on the face of the earth the patterns are distinctive, and there are many cases when it is important to distinguish between them. Lines are illustrated among the natural features by drainage lines; many of the phenomena produced by man himself are arranged in linear patterns, such as roads, fences, and political boundaries or property lines. The movements characteristic of kinetic regions are usually linear. The nodal region, defined by Whittlesey as being organized around a focus,[9] usually, but not necessarily always, consists of a pattern of lines. We must realize that a line, such as a road, can be transformed into an elongated area by enlarging the scale; on the other hand some lines, such as boundaries, which have the property common to all geometric lines of possessing length but no breadth, remain lines regardless of change of scale. Many settlement forms are arranged in patterns of points, as are also mines, manufacturing establishments, and other human phenomena. Like lines, many kinds of points become discrete areas upon enlargement; but the points used in geodesy remain points at all scales.

Some phenomena form patterns of areas or patterns of volumes. For example, soil types cover areas, as do also many of the forms of land use and forest cover, or the national territories of politically organized units. Air masses and climates are actually volumes, although mapping techniques usually require that they appear as areas.

Continuities and Discontinuities

Differentiation on the face of the earth where it is based on patterns of areas or patterns of volumes, involves still another important distinction. There are differences of degree, and differences of kind. Where the phenomenon being studied is arranged in a continuous cover over the earth, varying in intensity from place to place, we have what may be described as a continuity, in which differences from place to place are differences of degree, not kind. Examples of continuities are rainfall, air temperature, or degree of slope. Where we are dealing with continuities on a map some kind of iso-line is used, connecting points of equal value or ratio, such as isohyets, isotherms, or contours. These lines do not mark boundaries between different kinds of things, even though they are sometimes so interpreted: they do indicate the direction of greatest variation in intensity, which is always at right angles to the line.

On the other hand, where the phenomenon being studied is arranged in discrete units, each differing in kind from other units about it, we have what might be described as a discontinuity. The core of each discrete unit differs in terms of the

[9] See the chapter on "Regional Geography" prepared by a committee of which Derwent Whittlesey was chairman, published in Preston E. James and Clarence F. Jones, eds., *American Geography, Inventory and Prospect*, to be published.

criteria by which it is defined from other units; and although the cores may be separated by transition zones, the lines which separate one area from another are boundaries and do not necessarily reveal the direction of greatest variation. Area units defined by announced criteria in a continuity do not have cores, for there is a continuous transition from one limit to the other, as from a 20-foot contour line to a 40-foot contour line. Area units defined by announced criteria in a discontinuity must be interpreted quite differently. Examples of the latter are air masses, soil types, vegetation associations, and forms of land use.

For purposes of analysis with iso-lines, it is possible to transform discontinuities into continuities. For example, the land use map can be constructed on the basis of such a ratio as that of crop area to total area and thus the actual pattern of discontinuities is changed into a map pattern of continuities. The uses of this technique have been presented by Wellington Jones.[10] Density of population, on the other hand, probably should be related to discrete work areas which form discontinuities, rather than to an arbitrary total territory. The dasymetric map which distinguishes discrete areas of this or that density may have advantages over an isopleth map of population, where the variations of density are treated as a continuity.[11]

Processes

All these patterns of lines, points, areas, and volumes, whether static or kinetic, and whether arranged as a continuity or a variegated design of discontinuities, are a reflection of processes. And many fundamentally different kinds of processes are at work on the face of the earth. These processes differ in the nature of the sequences of change, the methods of measuring and describing them, and in the tempo or rate of change.

At least three major groups of processes can be distinguished. There are physical and chemical processes which proceed in accordance with the precisely formulated laws of physics and chemistry, and which are studied and described by the fields known collectively as geophysics. Geography is closely related to geophysics because certain kinds of area differences on the earth result directly from this group of processes. There are biological processes which are described by the somewhat less precise laws of the biological sciences. The biological processes, however, are modified in important ways by the physical and chemical processes associated with them unsystematically in particular places, and the study of such relationships is known collectively as ecology. Geography is closely related to ecology because of the many area differences on the earth which are the result of the interaction of the biological processes with those of physics and chemistry. And there are also the cultural processes, which may be subdivided into the traditional economic, social,

[10] Wellington D. Jones, "Ratios and Isopleth Maps in Regional Investigation of Agricultural Land Occupance." *Annals of the Association of American Geographers,* XX (1930): 177–195.

[11] John K. Wright, "A Method of Mapping Densities of Population, with Cape Cod as an Example," *Geographical Review,* XXVI (1936): 103–110; see also *idem,* "Some Measures of Distributions," *Annals of the Association of American Geographers,* XXVII (1937): 177–211.

and political; these processes are still somewhat inadequately described by the principles of human behavior, formulated by the several social sciences. These cultural processes are modified by their interaction with the processes of biology, and physics and chemistry associated with them unsystematically in particular places. Geography is closely related to studies of human culture—to economics, sociology, political science, social psychology, and social anthropology, because human culture too results in the development of major area differences from place to place in the earth.

The methods of studying these different kinds of processes are notably contrasted. Among the natural sciences, whether they deal with physics or chemistry, or biology, the observer is outside of the process he is observing. To be sure the act of observing may so change the thing observed that it is not always possible to look directly at the process itself. But the investigator is still an outsider. In the social sciences, on the other hand, the observer is a part of the process he is observing, and is himself a product of a culture. In the formulation of laws in natural science a rigorously controlled method must be used; but once formulated and tested, any college freshman can apply the laws, and can be judged right or wrong on the application. In the formulation of general principles in the social sciences, on the other hand, intuitive judgment plays a major part. In order to evaluate the results of investigations in the social sciences it is essential to be informed concerning the personality of the investigator. The personality of Einstein must be known in order properly to evaluate his pronouncements in the fields of economics or politics; but it is of no consequence at all with respect to his theoretical concepts in physics. It is true that modern social science is formulating forecasts of human behavior based on actuarial methods, but even here the selection of categories of phenomena to count, and the interpretation of the results obtained requires a large measure of intuitive judgment.

Structure, Process, and Stage

Area differences on the earth are a reflection of the operation of all these different kinds of processes as they are associated in specific places. It is true that the processes of physics and chemistry, especially those giving rise to atmospheric differences from place to place, are only to a minor degree affected by the processes with which they are unsystematically associated. Therefore, it is possible for a geographer to specialize topically in some aspect of physical geography, especially in climatology, and find that specialized knowledge of places is of minor importance except, perhaps, for studies of microclimates. But biological processes, as described from laboratory experiment, are modified in important ways by the physical environment in particular places. Knowledge of place in plant or animal ecology is certainly equal in importance to knowledge of process. Cultural processes, it would seem, are more profoundly modified by the conditions of the total environment in which they operate than are other kinds of processes, so that general concepts seem to have less importance than the variations imposed by the unsystematically associated factors. In cultural geography, it appears, knowledge of place is even more important than knowledge of topic.

In any case, area differences can be described in terms of the simple formula proposed many years ago for the description of landforms by William Morris Davis.[12] Structure, process, and stage are the three elements to be considered. Structure, in the case of geomorphology, refers to the geologic structure and earth material on which the processes work. In the case of other processes, structure refers to the total environment, including relict features from the past, on which a process works. The sequence of changes characteristic of a process can be described in terms of stages. In so far as the sequence of change for a given process is well-known, and in so far as it is not subject to a large degree of modification by the other things in the same area, there is a strong possibility of forecast.[13]

Two Conclusions

This rapid survey of the kinds of processes and phenomena which exist together on the face of the earth, and, in association, give character to places, suggests two conclusions with respect to the actual operations involved in the definition of the regional concept. The first conclusion stems from our understanding of the contrasts in the kinds of processes at work on the earth. Considering the different methods necessary to measure and describe these processes, and the very different tempos with which they go on, ranging from the relatively slow changes of geologic time to the very rapid tempo of cultural change, we conclude that an attempt to define regions based on phenomena produced by a variety of different processes is dangerous and could lead to serious errors of interpretation. We may find ourselves trying to add things like cabbages and kings. We would be on safer ground if we should define several parallel systems of regions, each based on the operation of one process or a group of closely related processes. We should be very critical of regional systems based on the totality of the content of area, unless and until they have been validated by a comparison of component regional systems.

The second conclusion is that geography cannot be strictly contemporary. If we are to seek the meaning of area differences in terms of causes and consequences, this inevitably involves the time perspective, for processes must operate over time. Historical geography, which deals with the geography of the past and with the changes in geographical patterns through time, would seem to be inseparable from regional geography. We cannot even accept such a restriction as that which would select historical data solely because of their direct causal relation to contemporary

[12] William Morris Davis, "The Geographical Cycle," *Geographical Journal*, XIV (1899): 481–504.

[13] Among the many discussions regarding the identification and description of regions see especially: Vernor C. Finch, *Montfort: A Study in Landscape Types in Southwestern Wisconsin*, Geographical Society of Chicago, Bulletin no. 9, Chicago, 1933; Preston E. James, Wellington D. Jones, and Vernor C. Finch, "Conventionalizing Geographic Investigation and Presentation," *Annals of the Association of American Geographers*, XXIV (1934): 77–122; Ralph H. Brown and others, "A Conference on Regions," *Annals of the Association of American Geographers*, XXV (1935): 121–174; and Vernor C. Finch, "Geographical Science and Social Philosophy," *Annals of the Association of American Geographers*, XXIX (1939): 1–28.

conditions. The full perspective of the time sequence in so far as it is related to geographic patterns and processes is essential if we are to read the story of contemporary differences correctly. The regional concept, as it is presented in this essay, embraces not only the idea that patterns and associations of phenomena in particular places give distinctive character to those places, but also that the meaning of likenesses and differences between places is to be understood in terms of complex, continuous change, growing out of the past, and going on into the future.

There are certain dangers involved in the application of this second conclusion. It requires, for example, that we go beyond the things that can be seen by direct observation in the field. The sequences of change which we call processes are intellectual concepts, tested, to be sure, by the direct observation of what we think of as the resulting phenomena of area differentiation. But once a sequence of change has been clearly stated, it is easy to think we have found evidence to support it, and it requires considerable imagination and independence of mind to find conflicting evidence. We need only recall the years during which innumerable peneplains were identified and described; an example, it would seem, of the intellectually numbing effect of a clearly-stated, but over-simple theory. Yet in spite of the ever-present and essentially human temptation to find what we are looking for, we cannot well go to the extreme of refusing to look for anything. The deeper understanding of the patterns and associations of phenomena which produce area differentiation involves a search for meanings in terms of causes and consequences; and this search inevitably takes us away from the strictly contemporary.

THE DEGREE OF GENERALIZATION

When we attempt to go beyond the logical definition of the regional concept and to indicate what must be done, operationally, to identify meaningful regional patterns, we come at once to the problem of scale, or degree of generalization. Some degree of generalization is required if we are to define a homogeneous area no matter how small, for we must keep in mind that no two points on the face of the earth are identical. There is no such thing as a "unit area" which is truly and completely uniform in all its components. Sometimes we are inclined to think of such a feature as a single field of corn as constituting a unit which is not further divisible. The fact is, however, that in many corn fields less than half of the area of the field has corn on it. The field of corn is a generalization, defined by the presence of corn (which is relevant to a problem involving agricultural land use) and disregarding those parts of the area not used for corn (which are considered irrelevant to the problem). Even the smallest area, examined more closely would obviously be further divisible into more minute parts.

When we view the earth more broadly the degree of generalization necessary for the identification of homogeneous areas becomes greater, and the scale of the maps we use becomes smaller. What factors determine the degree of generalization most appropriate for a particular kind of problem? What is it that determines the smallest degree of generalization that we consider worth making?

A Consideration of Scales

Theoretically the range of choice between large and small scales is very wide. In practice, however, we find that most geographic studies in which area differences are identified and plotted on maps fall into two widely separated scale ranges. First, we find many studies in which the original plotting of data on maps is done at scales between 1/10,000 and 1/62,500. There are a few examples of area differences plotted beyond these limits: certain Soil Conservation Service maps of individual fields done at 1/8,000, certain urban studies, and even one attempt to map the rooms inside a house; and there are some examples of work done at smaller scales, such as the early land classification studies of the western United States under the direction of John Wesley Powell, done at 1/125,000. But the great bulk of what may be called detailed studies are within the scale range described. Such maps include the soil studies of the Soil Survey, the geological maps of the Geological Survey, the various land and land-use maps prepared for planning purposes, and the numerous studies of small areas by individual geographers which have been described as examples of microgeography. In contrast, we find many studies which show regional divisions of various kinds on maps of 1/3,000,000 or smaller. These are the maps of climatic regions, great soil groups, agricultural regions, regions of natural vegetation, and many others. These are examples of macrogeography.

It is interesting that there are few examples of studies involving the original plotting of regions on maps of intermediate scales. There is a wide gap between scales on which one inch represents a mile or less than a mile, and scales on which one inch represents 50 miles or more. Why have geographers not worked at these intermediate scales; and why have they not considered it worth while to make area divisions at scales on which one inch represents less than 800 feet?

When we examine the studies done in these two scale ranges we find that each is characterized by a fundamentally different method. The studies on large-scale maps with relatively small degree of generalization are based on direct observation of area differences in the field. The studies on the small-scale maps with a relatively large degree of generalization are perhaps generalized from large-scale studies, or are based on observations recorded in notes or on census data and other statistics. Since statistics are not usually available for small area units, studies based on such data must make use of scales appropriate to the detail of the information. But what about the very large-scale studies based on direct field observation: why, for example, is it customary to define a soil type or a phase of a soil type so that it embraces just a certain degree of variation and so that we must disregard the still more minute variations that plague the beginner in his first attempts to identify soils in the field?

Linton, in his paper on "The Delimitation of Morphological Regions,"[14] makes the statement that "nature offers us two inescapable morphological unities and only

[14] D. L. Linton, "The Delimitation of Morphological Regions," in L. Dudley Stamp and S. W. Wooldridge, eds., *London Essays in Geography*, Cambridge (Mass.), 1951, pp. 199-217; ref. on p. 215.

two; at one extreme the indivisible flat or slope, at the other, the undivided continent." Why does he consider a flat or a slope to be indivisible? Surely, if we could stand out-of-doors together to look at these things directly, we could not find a natural slope so uniform that a close examination of it would not bring to light many minute differences; surely in nature we could not find a flat so utterly flat that minute variations of slope could not be identified and mapped, if it were worth our while. Is it really nature—that is, the phenomena existing outside the human mind —that tells us a flat or slope is not further to be divided?

The writer believes that the answer to the questions concerning the minimum size units which we consider to be relevant for geographic study must be found in the fact of the physical dimensions of man himself, not in the objective reality of nature. When we identify and record area differences by direct observation, man himself is the instrument of observation. What he thinks of as the smallest indivisible unity is determined not by the facts of area differentiation, but by man's average height and the average distance between his eyes. The observer views the earth from the vantage point of a position between five and six feet above the ground and with a perspective given by the three inches or so between his eyes. What he sees is a result of his preconceptions, and the physical dimensions of his body.

To appreciate this more clearly, let us imagine two different situations. First, if men were no taller than ants and were carrying on an ant-size investigation of the area differences on the face of the earth, can it be supposed that what we see as an indivisible flat would appear similarly indivisible to them? Or, if human observers were of such giant stature that the United States, in proportion, would fit within a forty-acre field, can it be supposed that this new kind of geographer would be concerned with what we call soil types? It seems more probable that he would identify as indivisible the area differences we describe as the major physiographic regions, and that in mapping out these areas he would be called a microgeographer. To be sure, the people who are making use of the earth at these contrasted sizes would mark out fields and properties in proportion to their stature: the ant-size men would make ant-size fields; and the giant would think of all North America as his private homestead.

These considerations are not to be dismissed as pure fantasy. If we are to gain a deeper understanding of the differences from place to place on the earth we must be able to distinguish between nature-given objective realities, and those phenomena we see because of our own physical and psychological constitution. Faced with such uncertainties we do not need to abandon the regional concept as a delusion; for it is easily demonstrable that area differences do matter, and that meaningful categories of regions can be defined, and that being applied they bring results of value Much depends, however, on so defining categories of area that they are clearly relevant to an objective, and this requires that the purpose of any geographic study must be clearly and simply stated at the very beginning.

Objectives

A regional system, we must recall, is to be justified in terms of the purpose for which it is defined. It is justified if it illuminates the factors in a problem; it is not justified if it obscures the factors and relationships we are trying to analyze. Area divisions, when first presented, are of the nature of geographic hypotheses; and when they are demonstrated as valid by some acceptable systematic method, they furnish the basic conceptual framework on which geographic scholarship rests.

There is a wide range of problems which are illuminated by studies of the causes and consequences of likenesses and differences from place to place on the earth. Certain kinds of studies are properly considered as "basic research," in that they contribute to a more effective formulation of the concepts of our field, to the definition of more illuminating regional systems. The writer suggests that basic research in the field of geography may be aimed at one of the following four objectives: 1) to gain a further understanding of the kinds of area differences observable on the earth, and of the processes which have produced them, and of the foreseeable consequences of the continued operation of these processes; 2) to define more precisely the sequence of changes associated with a specific process as it operates in specific places; 3) to formulate or evaluate broadly applicable concepts or theories regarding the significance of area likenesses and differences on the earth; or 4) to test methods or techniques. Geographic studies may also be applied to economic, social, political, or military problems where the chief contribution to be anticipated from the application of geographic methods is an increased perspective regarding the parts played by the various factors in the problem. Geography, among the social sciences, analyzes the importance of the modifications of specific processes by the other processes with which they are unsystematically associated. Geographic studies contribute to a clarification of the issues involved in decisions of public or business policy by defining the predictable consequences of proposed courses of action when carried out in the total environments of particular places.

Objectives Served by Small-Scale Studies

On map scales of 1/3,000,000 or smaller it is not possible to record direct observations of area differentiation. Where one inch represents 50 miles area differences visible to a man are too small to appear on the map. The boundary lines must be highly generalized. To be sure it is possible to establish the position of regional boundaries at certain places and to interpolate between these places, as Shantz and Marbut did in their maps of vegetation and soils in Africa.[15] It is also possible to prepare a generalized map on the basis of detailed studies, as when land use maps are transformed into "Types of Farming Maps," or when maps of soil types are combined into "Soil Associations."

Most regional systems defined for use on small-scale maps are based on statistical data. In some cases the boundaries do not follow specific values, as in many of

[15] H. L. Shantz and C. F. Marbut, *The Vegetation and Soils of Africa*, American Geographical Society, Research Series no. 13, New York, 1923.

the agricultural regions which appeared in *Economic Geography.*[16] In many cases, however, regional systems have been defined in quantitative terms; the climatic regions of Köppen or Thornthwaite, or the agricultural regions of Hartshorne and Dicken, for example.

The various kinds of maps prepared at scales of 1/3,000,000 or less do not usually permit close analysis of the area relations of the patterns they reveal. With area divisions based on such highly generalized criteria, in the definition of which so many underlying differences must be neglected in order to identify a kind of homogeneity, comparison of one regional system with another for the purpose of establishing area relations or for the purpose of demonstrating causes and consequences is most difficult. Apparent area relations which seem to exist at these high degrees of generalization, have a habit of disappearing when they are sought on larger-scale maps. Even the generally discredited concept of environmental determinism finds its last refuge in macrogeographic studies.[17] The validity of a concept which can be seen only when viewed very broadly, and which cannot be demonstrated upon close scrutiny would seem to be open to legitimate doubt.

The chief utility of regional systems drawn with a high degree of generalization on small-scale maps would seem to be for teaching purposes. By teaching, the writer refers not only to class-room instruction, but also to the broader aspects of teaching which involve presenting geographic concepts to the general public, or to statesmen or military leaders. For this purpose the desirable qualities to be sought in a system of area differentiation are simplicity and significance to a topic. Over-complicated regional patterns defeat their objective; where the two principles are in conflict, simplicity outweighs significance. But to attempt to measure carefully the relation of one such system of regions to another is obviously futile; and the attempt to demonstrate the meaning of such small-scale regions by direct observation in the field leads only to frustration and confusion.

Objectives Served by Large-Scale Studies

One reason for the rapid development of microgeography during the past thirty years has been the dissatisfaction felt among many geographers with the vague, undemonstrable results of the more highly generalized macrogeography. Detailed studies were brought to sufficiently sharp focus on small areas so that the knowledge that was brought together was of direct use in planning for the better use of land by individual farmers. The Michigan Land Economic Survey, dealing with the cut-over and abandoned lands of the northern part of the state, mapped differences of land quality as small as five acres in extent. More recently the survey of Puerto Rico carried out under the direction of Clarence F. Jones, found that in such a mountainous terrain where field units were so small, it was necessary to map

[16] Series of papers on Agricultural Regions of the continents, indexed in the *Ekblaw Memorial Index* to volumes 1–25, Worcester, 1950.

[17] Griffith Taylor, ed., *Geography in the Twentieth Century,* New York and London, 1951; ref. Chapter I.

area differences as small as an acre. Studies of cities require mapping the use of each building, occupying a fraction of an acre.

We may suggest the tentative conclusion that studies which involve the use of land or land resources by individual persons require large-scale treatment with a relatively small degree of generalization. This is true whether the objective is to contribute to basic research, or to make application of the results to practical problems. The reason is, again, related to the stature of man. The size of the fields he lays out or of the buildings he constructs is of an order which cannot be reproduced on small-scale maps: the impress on the physical earth produced by the process of human settlement is visible only on large-scale maps. On maps of too large a scale, the human impress goes out of focus, as when we examine the details of a plot of ground four feet square; on maps of too small a scale the specific impress of human occupance is blurred by generalization. Where analysis of area relations is wanted, where it is desired to advise the individual farmer about his use of land, where objective causal connections between phenomena are to be demonstrated, the degree of generalization must be just enough to show the specific impress of man himself—not too large a scale and not too small.

But there are purposes, other than pedagogical ones, which suggest the use of scales smaller than those demanded for the specific analysis of man-land relations. Valuable as the detailed studies have proved to be, the criticism can still be made of them that they do not yield broad concepts of wide application, that their results apply to unique small areas of little general importance. Whether this criticism is entirely justified need not be argued here. Among the geographers are many who feel that the only certain results are to be obtained by mapping and analyzing detail; and there are others who feel the need for broader generalization. Both are in part right.

The fact is that detailed, large-scale studies cannot be completed fast enough to meet the need for them. Geographic analyses of many kinds of problems are urgently needed: there are problems involving business developments; there are problems concerning the results of public works programs; there are problems of technical assistance; and there are military problems involving the study of extreme and unfamiliar environments. To undertake detailed, large-scale studies of all these problems, as well as of the problems in basic research which interest the geographic profession would be impossible. There simply are not enough trained field geographers to do this work fast enough, even with modern aids such as air photography. The survey of Puerto Rico, covering an area of 3,421 square miles, required the services of 18 field men under the guidance of an experienced research director over a period of two and a half years. If all the geographical man-power of the Western Hemisphere were made available, it would scarcely be possible to complete more than four or five such surveys in the next five years. Long before the need for the geographical analysis could be satisfied, the problem would have been met with an action program. So it is that action programs are undertaken blindly, lacking the basic knowledge of the relevant phenomena or understanding of the processes combined in the area.

Objectives Served by Studies at Intermediate Scales

A possible answer to this dilemma is offered by exploration of the intermediate scales. There is a wide range between scales on which one inch represents one mile, and those on which one inch represents fifty miles. What could be done, we may ask, at a scale of 1/1,000,000, where one inch represents sixteen miles. The writer has made some investigation of the possibilities of working at this scale in studies of Northeast Brazil.[18] It seems possible that, with some modification of the technique and with the aid of air photography, the mapping of area differences by direct observation at this scale might be possible. The use of intermediate scales, where the degree of generalization is still not far removed from that required for recording the specific impress of human occupance, might make possible the more rapid coverage of larger areas without serious loss of meaning. Before we can discuss the operations involved in working at such scales, however, we must consider some of the problems and methods of recording field observations on maps.

Mapping at Different Scales

We should recall that the patterns of arrangement developed on the face of the earth and which can be observed at any degree of generalization, are made up of lines, points, areas, and volumes. For purposes of this essay we may omit discussion of the problem of mapping volumes, and consider volumes and areas together. In field mapping the use of lines and points on the one hand, and areas on the other, is important to discuss.

Before any area on the earth can be analyzed and its area relations to other phenomena studied, it is necessary to plot it on a base map. The base data in relation to which the area is plotted are lines and points. Long ago geographers devised a system of lines of latitude and longitude to form a grid over the surface of the earth. Areas were plotted on this grid. Latitude and longitude are significant lines in terms of solar relations, and phenomena plotted on them can be located with reference to the sun and to each other.

But there are many other kinds of relationships that, in certain problems, may be more important than relationships to the sun. It might be desirable, for example, to show such highly generalized features as agricultural regions or density of population with reference to the pattern of climates. For this purpose, the lines of such a quantitative system as that of Köppen might be considered as similar to latitude and longitude lines. Position could be plotted over the framework of climatic lines, and location with reference to the climatic pattern could be read directly from the map—without arguing for or against causal relationship. On large-scale maps the lines in relation to which areas are plotted are usually the roads, railroads, property lines, political boundaries, or other similar features.

In any case, the base map is made up of items selected from the available patterns of lines and points. We suggest that it is desirable to consider carefully the

[18] Preston E. James, "Observations on the Physical Geography of Northeast Brazil," *Annals of the Association of American Geographers*, XLII (1952): 153–176.

selection of relevant base data rather than uncritically to make use of traditional latitude and longitude. Having selected relevant base data, the area differences are then plotted by direct field observation.

The scale of the field map bears a direct relationship to the size of the smallest area difference that can be recorded. Items too small to show on the map can, of course, be shown by out-of-scale symbols; but those features which are shown to scale must occupy a certain minimum extent of territory to be visible on the map. Field men are in general agreement that where a fractional code[19] symbol is used to express a group of associated phenomena a space on the map something like a quarter of an inch on a side is required. If the categories of area require only a single letter or digit to represent them, the space on the map may be only an eighth of an inch on a side. If, then, the nature of a problem requires the mapping of area differences as small as a single acre, this would require the use of maps with a scale of 1/10,000 for fractional codes, or 1/20,000 for single digits. If the smallest area unit necessary to map occupies 40 acres, the map scales would then have to be 1/62,500 or 1/125,000 respectively. On maps of 1/1,000,000, the smallest area unit that can be recorded in scale, even with a single digit symbol, must cover at least four square miles on the ground.

These estimates of map space are, of course, somewhat flexible. Nevertheless there is a direct relationship between the areas occupied by the categories of regional divisions, and the scale of the maps on which they can be plotted. The estimates refer to the original plotting of data on field maps, not to the scale of the published maps on which they are presented. The latter, with use of color or solid black, can be considerably reduced.

Topographic, Chorographic, Global

So important is the consideration of the degree of generalization and the scale of field maps in our operational definition of the regional concept that the writer feels the urgent need for finding acceptable word-symbols to refer to them. The tendency to overlook the significance of the degree of generalization in thinking about regions may be in part due to the loss, through misuse, of the words originally devised for this purpose. In a previous paper the writer suggested attempting to recapture the original meanings of the words topographic, chorographic, and geographic.[20] Geographic, in this sequence, refers to studies of the world as a whole or its larger parts; chorographic refers to studies of intermediate areas; and topographic refers to studies of small areas. Since the word geographic stands for studies of area differentiation at any scale its use to refer to only the more general kinds of studies would not be accepted; for this reason we suggest the use of global studies to refer to this category.

The chief difficulty in this proposal has to do with the use of the word topog-

[19] Vernor C. Finch, *Montfort . . . , loc. cit.*

[20] Preston E. James, "The Terminology of Regional Description," *Annals of the Association of American Geographers,* XXIV (1934): 78–92.

raphy. At first chiefly by geologists and engineers, but now by many other people including many geographers, the word has been misused until it has lost its original meaning and now refers to surface features or landforms. Yet the term topographic map refers to a map of relatively large scale, and the topographic symbols include not only those which stand for relief features, but also those which show hydrography, culture, and in some cases the cover of vegetation and land use. These are all topographic features, when presented on large-scale maps. There is no compelling need for the word topography in the sense of landforms, for the words landforms, surface configuration, or relief are available and clear. But for the smallest degree of generalization there is no word: we must attempt to regain the original meaning of topography, or invent a new word. The writer, therefore, uses the word topography only to refer to degree of generalization.

Whatever terms the profession eventually agrees to use for these scale concepts, it is possible to suggest some sharpening of the definitions. A topographic study, as we propose to use the word, is one which makes use in the field of maps of sufficiently large scale to permit the plotting of the smallest relevant area units: such units as soil types; individual fields on a farm; individual clearings in a forest; or in urban studies, the components of the commercial core. When the scale of the maps on which data are originally plotted is too small to permit mapping these details, when the specific detail must be generalized into broader categories which do not show the specific impress of unit processes, we propose to use the word chorographic. Chorographic studies, however, are not so highly generalized that effective analysis of the area relations between different systems of regions cannot be carried out. For the highly generalized studies on maps of relatively small scale, where the analysis of area relations cannot be done effectively, we propose the word global.

Chorographic Methods

The methods of topographic study are well-known and need not be discussed here. Some preliminary experience in chorographic studies suggests certain observations concerning the methods to be used at the intermediate scales. In detailed mapping the observer can frequently see the whole of the area units he is plotting, and, from one spot, he can record the boundaries between categories in specific detail. But at the chorographic scale this is never possible. Even from an airplane it is not possible to see the whole of an area unit in sufficient detail to permit the plotting of all the specific details of its boundaries. We must remember that the smallest area unit that can be shown with its written symbol at 1/1,000,000 is four square miles. At such a scale the observer must synthesize his observations as he moves from place to place, combining the area units he observes directly into more general aggregations that are too big to be seen directly. He plots the outline of these areas in part from memory, and the boundaries he draws are necessarily smoother than those of any of the component details. By making use of the airplane, the air photograph, and other devices, as well as by training his memory, chorographic map-

ping can be done in the field when large areas, not previously covered by detailed studies, require investigation.

The problem is how to generalize sufficiently to permit more rapid coverage but at the same time not to blur the specific details of man-land relations which are directly tied to specific processes. Man's occupance of the land produces patterns which must be seen in topographic detail. When our purpose is to seek the meaning of area differences in terms of causes and consequences we make use of topographic-scale studies. When our purpose is to present the general results of such studies as in a classroom, we make use of global scales where simplicity is the quality most desired. The use of the chorographic scale is justified by the attempt to cover larger areas more quickly, but without losing the specific meanings derived from study of details. How is this to be done?

The first suggestion is that the categories of area for use at the chorographic scale be defined as associations of component details. Less satisfactory results are obtained from using the principle of the predominant type, that is, of identifying the feature which occupies the largest area and outlining the whole area in which this type is predominant. The older state soil maps were made in this way, and are very difficult to use in the field for this reason.[21] The newer soil maps where large areas are covered on smaller scales are based on associations of soil types, that is of categories defined in terms of component types which are commonly and repeatedly found grouped together in characteristic patterns of arrangement.[22]

As an example, consider the problem of mapping at the chorographic scale in the Corn Belt. At the topographic scale we could distinguish the use made of each field, and we could distinguish the woodlots from cleared land. But at such a scale as 1/1,000,000, where the smallest area division must occupy at least four square miles to be plotted with its written symbol on the map, it is not possible to distinguish the use of individual fields or even whole farms. The screen through which we view the area differences on the earth is so coarse that we cannot distinguish the use of the land by the individual farmers.[23] But for the purposes we have in mind—rapid coverage—we can define an association of uses that we find to be recurrent. The association might include all the land in the prevailing system of rotation and the commonly associated woodlots. This is essentially the make-up of the categories developed by the Department of Agriculture for its "Types of Farming" map. The resulting map is so generalized that one cannot read from it the meaning of area differences as they affect the individual farmer, yet one is not so far from the specific details of occupance as when the whole Corn Belt (defined as producing 3,000

[21] W. J. Latimer and others, *Soil Survey (Reconnaissance) of Vermont*, U.S. Dept. of Agriculture, Bur. of Chemistry and Soils, No. 43, Washington, 1930.

[22] U.S. Department of Agriculture, Yearbook 1938, *Soils and Men*, Washington, 1938; ref. pp. 979–989, and attached map; Charles E. Kellogg and others, "Soil Classification," *Soil Science*, LXVII 1949: 77–191.

[23] G. D. Hudson, "The Unit Area Method of Land Classification," *Annals of the Association of American Geographers*, XXVI (1936): 99–112.

bushels of corn per square mile) is described as a homogeneous area on a global scale.

Where associations of component details are defined and mapped, it seems essential to develop some acceptable method of tieing them back to the details of which they are composed. This requires a sampling technique. A considerable amount of experiment is needed to define the size of samples to be studied in topographic detail for the purpose of showing the components of an association. Presumably the larger the number of components included in an association the larger the area that must be covered to provide a true sample; but the arrangement of the components and the average size of the areas they cover must also be considered.[24] Then there is the question of whether samples should be selected by the application of some geometric pattern, or whether the trained judgment of the experienced field man still brings better results.

In any case, the development of chorographic-scale mapping techniques may offer at least a partial answer to the problem of increasing the significance of geographic research. Perhaps this offers the best opportunity to bridge the gap between microgeography and macrogeography, and to demonstrate more fully the essential unity of the whole field of geography.

THE ANALYSIS OF AREA RELATIONS

It is possible, then, to visualize the regional concept in terms of action. Area differences can be defined in terms relevant to a problem, and can be plotted on field maps with a degree of precision fully as great as that achieved by other non-laboratory sciences. By the development of a sampling technique, a greater degree of generalization can be used to permit wider coverage while at the same time specific details applicable to individual people in their use of earth resources are not lost. Geography seeks geometric precision; that is, it is concerned more than bordering fields of study with the exact measurement of areas and patterns, and from these more exact studies of area differences, it brings to light additional understanding of the role of relative location. Geography cannot find all the answers to economic, social, political, or military problems of a practical nature; but it can contribute to an understanding of the problems by applying its own individual kind of analysis.

Geographers are concerned with a wide range of professional questions. How to define categories of area difference more strictly relevant to objectives; how to observe and map the significant features of a region more exactly yet with fewer man-hours of work; how to present the results of a geographic study, especially so that non-geographers can appreciate the kind of contribution to be expected from such study. One of the facets of professional work has to do with the study of relationships between the phenomena that are mapped.

[24] Preston E. James, "The Blackstone Valley, A Study in Chorography in Southern New England," *Annals of the Association of American Geographers,* XIX (1929): 67–109; M. J. Proudfoot, "Sampling with Transverse Traverse Lines," *Journal of the American Statistical Association,* XXXVII (1942): 265–270.

It is necessary to distinguish between two kinds of relationships in which geographers are interested. There are area relations and there are causal relations. Area relations have to do with the relative positions of things, the spread and patterns of phenomena; area relations are found by observing the space dimension at any specific time. Causal relations, on the other hand, have to do with the changes systematically related to a process, they have to do with origins and developments, and with extensions into the future; causal relations are only to be observed through study of the time dimension. Let us consider briefly some of the ways in which geographers work with the regional concept for the purpose of bringing out more clearly the area relations of phenomena, and for discerning their significance. Of course, the fundamental tool for such research is the map.

The Map as an Analytic Device

The map serves many functions. In the field it provides the most precise way of recording observations. It reduces the patterns of area differences on the earth to a size permitting close analysis; patterns which otherwise would disappear from view in the merging lines of perspective on the curved surface of the globe. The map is an eloquent form of presentation for those trained to read its symbols; a form much more precise than the word symbols more commonly used. And between the work in the field and the final presentation of results, the map is used in the office as an analytic device.

Cartographic analysis brings to light different kinds and degrees of area relationship between phenomena. Of course everything on the face of the earth has some relation to everything else, but many relationships are discordant, and many, also, are accordant. Accordant relations are either coincident or correspondent. A coincidence occurs when two phenomena occupy exactly the same area on the earth; in such a case the boundaries outlining the areas occupied by the two phenomena are said to coincide. A correspondence occurs when there is a discernible similarity between the areas of occurrence of two phenomena. Perhaps the boundaries of the two areas are very close together, perhaps coinciding in most places, but departing from each other in a few localities; or perhaps they coincide nowhere, but are so close together that the similarity of the two outlines is apparent. Where two phenomena occupy approximately the same areas this may be called an *in situ* correspondence; but where they occupy wholly different areas, although with similar outlines, this may be called an *ex situ* correspondence. Discordant relationships exist when the patterns of two phenomena are wholly incongruous. These various kinds of area relations are shown by the accompanying diagrams (Fig. 1).

The identification of an accordant relationship is no proof of a causal relationship, although it may offer a strong indication of the existence of a causal relationship. Coincidence of two phenomena in area does not demonstrate that one is the cause of the other. A third cause may operate to produce the two phenomena mapped; or a coincidence of pattern may be only a temporary condition existing at a moment of time and of little fundamental significance. Although accordant area

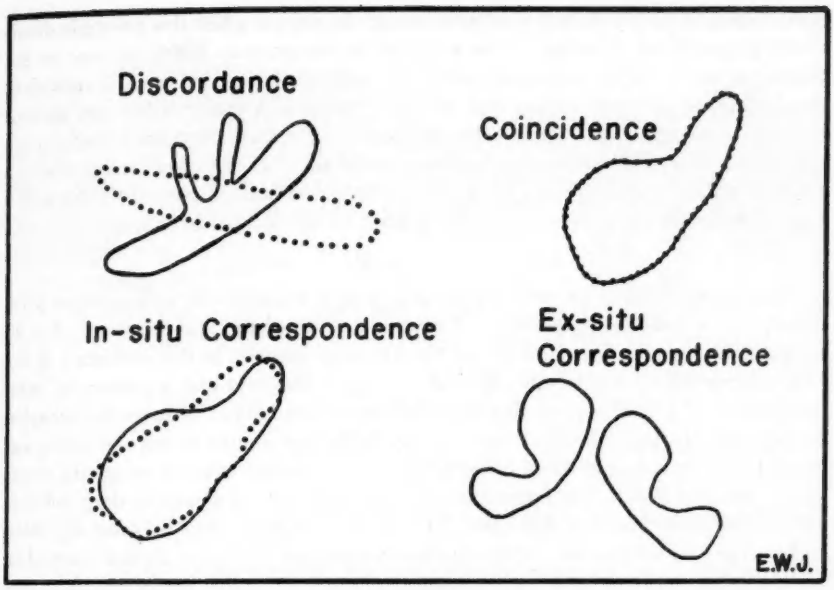


FIG. 1. Kinds of area relations.

relationship suggests strongly the existence of some causal connection, perhaps through the operation of a process still not mapped, the demonstration of causal significance must rest on the identification of the responsible process as it operates through time.

The writer cannot accept without reservation the formula suggested by Hettner[25] and reported by Hartshorne,[26] to the effect that phenomena which lack causal connection are to be rejected as data for geographical study. It would seem entirely suitable to map phenomena for the purpose of discovering causal connections, even where the patterns seem at first sight to be entirely incongruous. Our failure to see the congruity of the patterns may be a reflection of the state of our knowledge. Furthermore, if the results of a study of this sort are purely negative—that is, the relationships are found to have no causal connection, and any accordance of pattern is purely a matter of chance—even under these circumstances the work is justified and the conclusions may be of importance.

The dangers of arriving at conclusions regarding causal relationships without study of process in time perspective are amply demonstrated by the history of our professional writings. The concept of environmental determinism[27] was given ap-

[25] Alfred Hettner, *Die Geographie, ihre Geschichte, ihr Wesen, und ihre Methoden*, Breslau 1927; ref. pp. 110–132.

[26] Richard Hartshorne, *op. cit.*, p. 240.

[27] Griffith Taylor, *op. cit.*, p. 16.

parent support by much field evidence during the period when this principle dominated geographical thinking. The evidence, however, was faulty because of the technique used. Again and again in the literature of that period we find coincident area relations between natural and cultural phenomena asserted but not demonstrated. And again and again when we actually measure these area relations we find examples of correspondence but not coincidence. If the places where the two phenomena fail to coincide are examined in detail, we find processes at work which invalidate the theory of determinism as applied to the occupance of land.

An Example

To illustrate this point more clearly, the writer will describe an imaginary area, greatly simplified by the omission of many elements of the real situation. Let us suppose our purpose is to understand the meaning (causes, in this instance) of the area relationships between the physical quality of the land and a pattern of rural settlement. We shall assume that an individual community of farmers has occupied an intermont basin. The land used for hay fields and for the pasture of cattle was cleared from an initial cover of forest which once extended over the mountain slopes and basin floor alike. The basin itself is made up of gentle slopes on deep volcanic ash of essentially uniform character. It is bordered on all sides by relatively steep rocky slopes with thin soil. This situation is pictured in Figure 2, and mapped in Figure 3.[28]

Geographers have often been confronted with this kind of situation and there are many reports describing fundamentally similar relationships. There are two ways of proceeding, so far as the mapping and the cartographic analysis are concerned. One is to observe the essentially coincident relations between basin and land cleared for farming, and to record the observation in descriptive notes and on a field map. Two categories of area are defined: steep, rocky slopes still covered with forest; basin floor cleared and used for hay and pasture. One might be led to assert that the settlers were engaged in adjusting themselves to the determining quality of the land, or, in the terminology of determinism, that here was a response to environmental influence.

But the close observer, trained to be critical of his preconceptions, would note that at the eastern side of the basin there was a small but not inconsiderable area where the steeper mountain slopes had been cleared and were used for hay and pasture; and that in the western part of the basin floor there were patches of uncleared forest. If the two categories of area are to be distinguished by a single line, where is that line to be drawn?[29] Is the bit of cleared mountain slope to be included with the mountain or with the cleared land? Are the patches of forest on the basin

[28] See, for example, Roderick Peattie, "The Conflent: A Study in Mountain Geography," *Geographical Review*, XX (1930): 245–257; Preston E. James, "Regional Planning in the Jackson Hole Country," *Geographical Review*, XXVI (1936): 439–453.

[29] This same problem with somewhat different elements is exhaustively analyzed in Siegfried Passarge, "Wesen, Aufgaben, und Grenzen der Landschaftskunde," in *Hermann Wagner's Gedächtnisschrift, Petermanns Mitteilungen*, Ergänzungsheft 209, 1930, pp. 29–44.

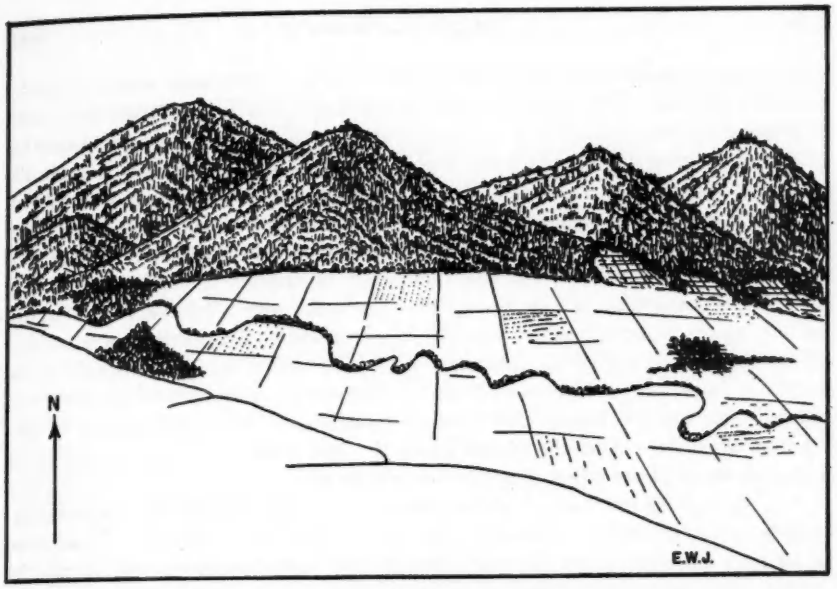

N
E.W.J.

FIG. 2.

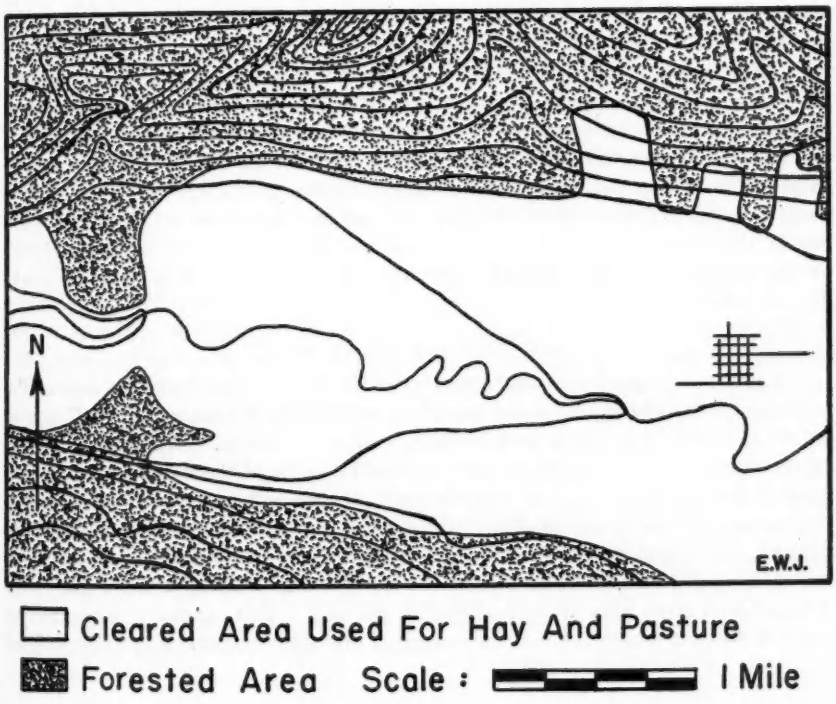

N
E.W.J.
Cleared Area Used For Hay And Pasture
Forested Area
Scale :
1 Mile

FIG. 3.

floor to be included with the forest on the slopes, or the basin which is mostly cleared? Of course, the problem makes no sense and therefore cannot be answered. It arises from the attempt to define categories of area which include the association of too many unsystematically related phenomena; whatever decision is made the result is to obscure the meaning of the area relationships, the factors in the problem.

The other method of proceeding does perhaps require more careful observation of details in the field, and certainly involves more precise mapping. The component parts of the area are separated and each is mapped as an individual item. Whether this mapping is done on separate bases, or, with a fractional code symbol on one base is a matter of convenience. The important thing is that the associated phenomena be examined as separate, overlapping patterns. Examination of the resulting maps in the office reveals an *in situ* correspondence between basin and cleared farm land. The search for causal connections, however, leads one to concentrate attention not on the places where the two phenomena are coincident, but rather on those places where they do not coincide.

As soon as the analysis of area relations reveals the existence of a problem, attention is focused on the process of clearing and settlement, viewed as a sequence of changes extending from the past, through the merely contemporary, on into the future. Suppose that we find that the movement of the settlers into the basin was from the east, and that a series of maps showing the spread of the cleared land at various stages could be prepared. We might then find that the relict patches of forest on the western part of the basin floor had not yet been cleared because the movement of new clearing had only just reached them; and we might also find that when the basin floor which was more accessible and desirable had been occupied, settlement was in fact spreading onto the bordering mountain slopes. We would recognize, then, that the contemporary picture of a near coincidence between cleared land and basin was only a momentary stage in a process, which in the course of time would result in the complete disappearance of the coincident relationships. We would, then, be led to examine the slopes for evidence of erosion, and we would seek in the culture of the inhabitants for previous experience with these different qualities of land.

The Significance of the Land

A major concept of modern geography holds that the significance to man of the physical quality of the land is not something which remains the same for all men at all times; rather it is determined by the attitudes, objectives, and technical abilities of the settlers, and with each change in these elements of the culture, the physical land, or resource base, must be re-evaluated. Modern geography does not deny the importance of the physical quality of the land: it differs from the deterministic concept by asserting that only when the land itself changes does it exert a positive force on what people do with it; as long as the land remains relatively unchanging, man himself determines how the land affects his use of it. This concept is supported by field evidence in which process is investigated through time; and it can be validated

not with respect to broad, highly generalized areas, but for the most intimate details that are revealed by topographic study.[30]

The Degree of Generalization in Area Relations

One further warning regarding the methods of examining area relationships needs to be offered. When two phenomena are to be analyzed cartographically for the purpose of discovering accordant or discordant relations, it is essential that they be mapped originally on the same scale with similar degrees of generalization. To seek for area relationships, let us say, between the highly generalized lines of the Köppen climatic system, drawn on a global scale, with the much more detailed boundaries of "Types of Farming Areas"[31] drawn on a chorographic scale would be methodologically unsound. Nor should the boundaries of a system of climates plotted on a global scale be compared with patterns of vegetation plotted in chorographic or topographic detail. When comparisons of this sort are undertaken, the phenomena being analyzed should each be developed as a system of regions separately, but with the same degree of generalization.

CONCLUSIONS

The regional concept involves the idea that there are associations of phenomena to be observed on the earth; that these associations, and the patterns of their individual elements, are significant of the interacting processes at work on the earth; and that these associations give character to particular places. For some purposes the synthetic approach to the definition of area associations may be justified: especially for pedagogical purposes the simplicity of a synthetic region, like the basin floor cleared for farming, and the steep, rocky, uncleared slopes, may offer a compelling reason supporting this kind of approach. Some geographers, however, will prefer to develop their more highly generalized regional systems on the basis of the cartographic analysis of component parts, building up by analysis rather than asserting by an initial synthesis.

By these various methods, however, geographers are seeking accordant relationships, and having discovered them to demonstrate the causal connections through the study of the processes involved. Simply to define and map a system of regions without investigation of underlying processes operating through time, and without showing clearly the relevance of the regional system to the underlying purpose, comes perilously close to what Kimble calls "doodling." The regional concept, as presented here, involves the time perspective as an integral part.

Geographical study based on the regional concept recognizes the need for focusing attention on place rather than on isolated process. It accepts from other fields the illumination cast by knowledge of process as it operates in an isolated system, and clearly recognizes the extraordinarily fruitful methodology of process study. But the geographical field also can make distinct contributions. It contributes to

[30] Preston E. James, *A Geography of Man*, Boston, 1951; pp. 40–45; 234–254; etc.

[31] Map by the U.S. Department of Agriculture.

an understanding of the meaning of area differentiation, and of the operation of processes in particular places. It focuses attention on the modifications in the operation of processes by the other things that are not equal, by noting the actual operation of processes in particular places modified by the presence of the other things unsystematically associated there.

Individual scholars do not attempt to cover this whole broad, complex field. Rather they specialize in small parts of it, topically in certain groups of related processes, and regionally in certain limited areas where conditions are similar. Competence in geography is not easily gained, and even for a limited sector requires a lifetime of devotion. The geographers, whatever their specialties, are united by the concept which underlies all their investigations, and by the cartographic field methods and methods of analysis which lead to a deeper understanding of the meaning of area difference. The concept, to which we have attempted to give both a logical and an operational definition, is the concept of area differentiation based on patterns and associations of phenomena and meaningful in terms of continuing processes of change. This, the common denominator of geographical study, is what we know as the regional concept.

RURAL SETTLEMENT TYPES IN THE UTTAR PRADESH (UNITED PROVINCES OF AGRA AND OUDH)

ENAYAT AHMAD
Patna College, India

THE patterns of rural settlement in the Uttar Pradesh (Fig. 1) show interesting correlations with both the physical and cultural background. Larger agglomerations are more characteristic towards the drier west in an area which has had less security in the past. Towards the east hamletting, or the fragmentation of settlement, seems to be related to such a variety of factors as greater security in the pre-British days, more surface and underground water, and different land tenure and social conditions. In the Himalayan area relief is one of the main factors determining the distribution and dispersal of settlements.

TYPES OF RURAL SETTLEMENTS AND THEIR DISTRIBUTION

Four main types of rural settlements may be distinguished within the Province, now called State (Fig. 4). These are: 1) compact settlements; 2) "cluster-and-hamlet" settlements; 3) fragmented or hamletted settlements; and 4) dispersed settlements. The distribution of these various settlement types is markedly related to features of the physical setting. These features are shown in Figure 2, and the major surface regions are indicated on Figure 3.

Compact Settlements

The compact settlements cover by far the largest area of the province, occupying almost the whole of the Doab (Figs. 3 and 4), the Trans-Jumna Plain, the Bundelkhand Upland, the Upper Ganges–Gogra Doab, the Tarai, and the well-marked levees or uplands in eastern Uttar Pradesh near the large rivers, like the Ganges, Gogra, and Rapti. The chief feature of this type of settlement is the concentration of almost all the dwellings of a *mauza*[1] in one central site.

The compact village thus occurs mainly in the western parts of the Ganges Plain and the Central Indian Foreland. The Doab[2] (Fig. 3), in which the large agglomerated village predominates, is a relatively dry region receiving rainfall of less than 30 inches. Although the interfluve is mostly a flat and fertile plain of older alluvium it is traversed in the middle of its northern half by some *bhur* (low sandy

[1] The Survey village, which is a parcel of the ground with definite boundaries which may contain one or more groups of houses.

[2] In popular usage, the 'Doab' in the Uttar Pradesh always means the Jumna–Ganges Interfluve. When we mention other interfluves we invariably prefix to the word 'Doab' the name of the bounding rivers.

ridges) and patches of *usar* (salt-impregnated soil). Water-logged areas are not infrequent in the Middle Doab. The region has a considerable area of ravines in its southern half along the Jumna and is fringed on either side by the newer allu-

FIG.1

vium which, along the Ganges, is 5 to 15 miles wide. Because of the infertility of the land, the size of agglomeration becomes small in the *bhur* tract, while in the *usar* zone hamletting (spreading or fragmentation of settlements) may be noticed, and in the wider belt of *khadar* (newer alluvium) dispersal is quite common.

The Ganges–Gogra Doab (Fig. 3), the northern third of which is characterized by compact villages, is wetter than the Doab with a rainfall of from 30 to 40 inches. The water table, as a whole, is higher in this area than in the Doab where it is 20

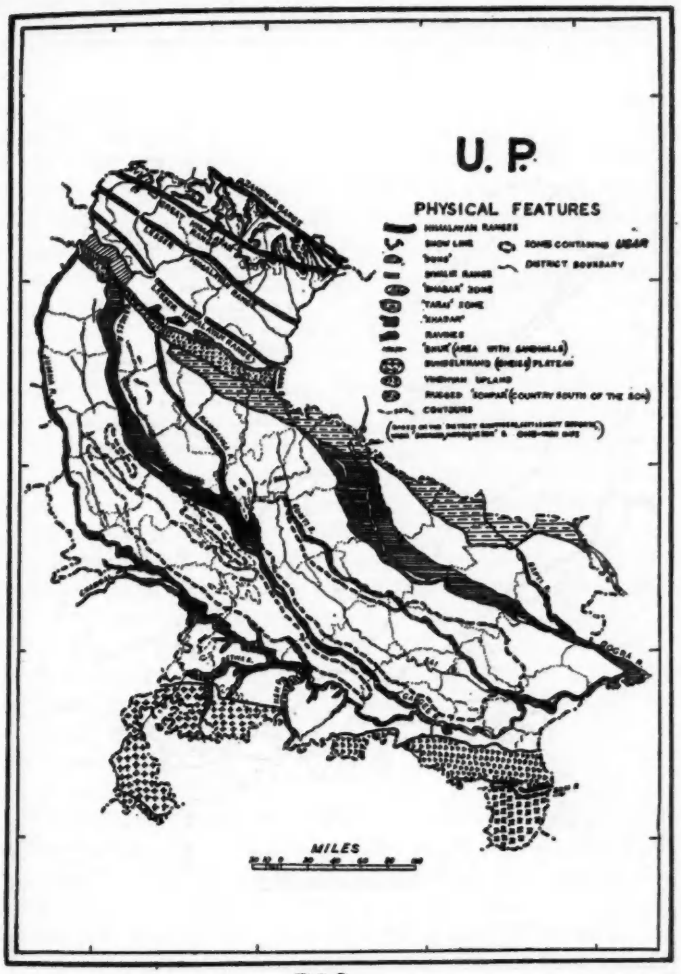


FIG. 2

to 70 feet below the surface. *Usar* covers a vast portion of this region, but the compact settlement is found in the *usar-free* northern section. However, probably owing to greater moisture, the size of the compact village in this region is not as large as in the Doab.

The Trans-Jumna Plain, another region of compact settlement, extends south of the Jumna river from Muttra to Allahabad and is a rather precarious tract. Ridges of the metamorphic Aravallis and sedimentary Vindhyans (Fig. 2) appear in the west offering sites for large strong-point villages. A considerable proportion of the

FIG. 3

ground is cut by ravines along the main streams which occupy deep-cut channels 50 to 150 feet below the general level of the country. The dissecting ravines have caused appreciable desiccation by lowering the water table which ranges from 50 to 90 feet below the surface.

Compact villages are also predominant in the southern half of the Sub-Himalayan Plain, the Tarai (Figs. 2 and 3), which is a moist tract. This moist zone, which is often marshy, is a narrow, clayey strip. Along its southern side, the water of the foothill streams, which sinks underground in the pebbly plain to the north, reappears and flows through poorly defined channels. Although the occurrence of compact villages in this moist plain is somewhat surprising we shall presently see its causes.

Compact villages are again the settlement type of the *Bundelkhand Gneiss Upland*[3] (Fig. 3), the western part of the Central Indian Foreland. The surface is marked by narrow residual ridges of quartzite forming strong-points of settlement in this historic zone of strife lying between the Deccan and the Hindustan Plain. In spite of rainfall of from 35 to 40 inches, the zone suffers from lack of water occasioned by quick run-off and rocky substrata rendering construction of wells difficult. Tanks, formed by embankments constructed across drainage lines, have, therefore, worked as a clustering force.

"Cluster and Hamlet" Settlements

This type differs from the compact settlements by reason of the existence of a few separate hamlets, usually, one or two, in the *mauza* apart from the compact village. This is in reality a transition type and is found roughly in those tracts which lie between the zones of compact and of fragmented settlements. It is characteristic of a zone in the Middle Ganges–Gogra Doab, a small part of the Doab, and a narrow zone surrounding the area of fragmented type (Fig. 4).

The proportion of *usar* in the middle portion of the Ganges–Gogra Doab is great and appears, in combination with a relatively high water table, to be one of the causes of the "Cluster and Hamlet" settlement type. This same type is also common in the *Trans-Ganges Plain* which lies east of Allahabad and south of the Ganges. This area is wetter than the Trans-Jumna Plain and has a higher water table (30 to 50 feet below the surface). Its loamy soil is more fertile than the sticky black soil of the Trans-Jumna Plain.

Fragmented or Hamletted Settlements

The third type, the Fragmented Settlement, is characteristic of the eastern part of the Ganges–Gogra Doab, the southern half of the Trans-Gogra Plain, and the Vindhyan Upland. The settlement of a *mauza* in this type consists of a main site and several hamlets or "fragments" standing separate from one another and often scattered over the entire *mauza*. The dispersal of population into the several hamlets is so marked that the main site is much smaller than in the foregoing two types of settlements and indeed, if only size is kept in view, it is often difficult to distinguish the main site from the surrounding hamlets. In Sultanpur, a district typical

[3] The name of that part of Central India and the adjoining Plain which lies roughly between the Betwa and the Son River and south of the Jumna. The Bundelkhand of the Uttar Pradesh means the Jhansi Division (Fig. 1).

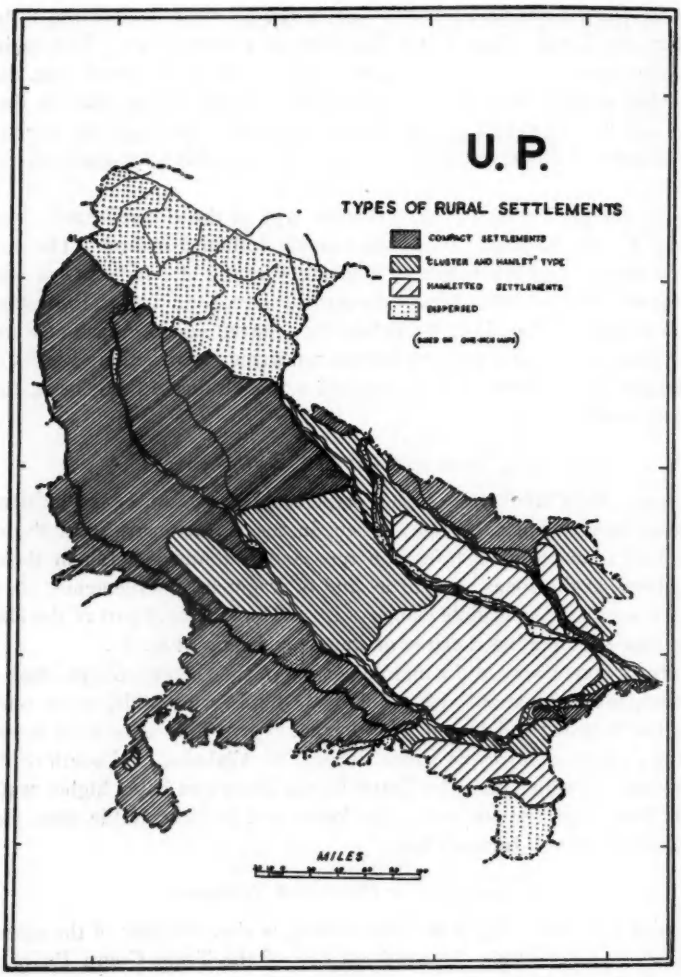


FIG. 4

of fragmented settlement the number[4] of inhabited sites per inhabited *mauza* is five. In Gonda district it is over six.[5] Some *mauzas* of the zone contain as many as 50 to 60 hamlets.

[4] Based on J. A. Fordham, *Final Settlement Report of District,* Sultanpur, 1940 and B. Sahay, *Census of India, 1941, V.U.P. Tables,* Delhi, 1942. Note: Works referred to in this article, except in those cases where the place of publication is mentioned, are Allahabad imprints.

[5] Derived from J. K. Singh, *Final Settlement Report of Gonda District* (1944) and B. Sahay, *Census of India, 1941, V.U.P. Tables,* Delhi, 1942.

In the eastern Ganges–Gogra Doab, the proportion of *usar* is great and the water table is high. The Trans-Gogra Plain, or "Sarjupar," *i.e.,* the country north of the Gogra and east of its tributary the Sarda, is a moist area (40–50 inches rainfall) with a high water table, less than 15 feet from the surface. Almost one-third of the area (excluding the Tarai) consists of *khadar,* which, since it is recently deposited friable loam and is naturally moist as a result of the rivers and of seepage from the moist sub-montane area, is well-suited to the development of hamletted settlement.

Hamletted settlements are also common in a considerable portion of the South-Eastern Upland, the eastern part of the Central Indian Foreland (Figs. 3 and 4). The northern half of this region is the Kaimur Upland which is formed of Vindhyan sandstones (probably a peneplain rejuvenated during the Tertiary upheaval). It has some forest patches and is more moist than its western counterpart, the Bundelkhand gneiss upland.

Dispersed Settlements

The dispersed type is the characteristic settlement of the Lesser Himalayas, the Duns, the Bhabar, the Siwalik Range (wherever it is settled), the *Sonpar* (the Archaean country south of the Son), and the *khadar* of some rivers especially the Gogra and the Ganges (Fig. 2). It must be mentioned that the dispersal noticed here is not of the type existent in the newly settled countries of the world, like North America, Australia, or Argentina where almost every rural homestead stands in a separate farm. Here dispersal may be regarded as relative. The houses are not usually grouped into compact agglomerations as in the Ganges Valley; generally they stand separate from each other though all of them may not be on separate farms in the midst of cultivation. What is significant is the relatively long distance between dwellings compared with the congestion of the plains settlements.

The Himalayan region, which is the main zone of dispersed settlement, is divisible into four sub-regions. In the north is the Great Himalayan Region (Fig. 3), consisting of the cis-Tibetan zone of marine fossiliferous sedimentaries and the Great Himalayan range of crystalline metamorphics and granites. The region is mostly above the snow line and is noted for its ruggedness which is to a great extent the result of frost action. Sparse and scattered population is located in the narrow valleys—the head-streams of the Ganges and the Sarda rivers. We have insufficient information about the type of settlement in this region. The Lesser Himalayan Region, which is the largest zone of dispersed settlement in the Uttar Pradesh, is mostly between 3,000 and 10,000 feet above sea level. It covers much of the Garhwal Nappe zone and the surface is developed largely on unfossiliferous Palaeozoic sedimentaries and metamorphics. Because of relatively high rainfall, this zone has a maturer topography than the Great Himalayas, showing frequent inversions of relief. It is forest-covered for the most part, yet it forms the main inhabited zone of the Himalayan region. Relief and forests appear to be the main causes of dispersal here. The Duns which are also characterised by dispersed settle-

ment, lie between the Siwalik Range and the Lesser Himalayas. They are tectonic, longitudinal, and rather fertile valleys of gravel and alluvium underlain by the Siwalik sedimentaries. The Siwaliks (Figs. 2 and 3) of relatively uncompacted rocks (sandstones, shales, sandrocks, and conglomerates) form a narrow forested zone about 2,000 to 3,000 feet above sea level. It is a practically uninhabited zone, but where settlement occurs it is dispersed.

The northern half of the sub-Himalayan plain, called the Bhabar (meaning porous), is a zone of dispersed settlement. It is a gravelly and shingly foothill plain (really a series of alluvial fans which have expanded laterally to join one another forming a continuous plain). Most of the streams lose themselves in the porous pebbly ground.

FACTORS WHICH HAVE CONTRIBUTED TO THE AGGLOMERATION OF RURAL SETTLEMENTS

Before entering into a regional discussion of the types of settlements we may consider here some of the important factors which have contributed to the agglomeration or fragmentation of settlements in the area. The causes for the dispersal of settlements in the Himalayan and sub-Himalayan area, the Sonpar, and the *khadar* are much different from those operative in the rest of the provinces and will be discussed along with the description of the dispersed type.

Uniformity of Relief and Soil Fertility

The proverbial monotony of the Gangetic Plain is well suited to the agglomerated type of settlement. There is no irregularity in the relief to cause diffusion of resources. The general sameness of scene has fostered a sense of community. Though there are variations in the nature of soils from region to region and even within the limits of the same *mauza,* the general productivity of the soil in most parts of the plain is more or less uniform and this fertility has enabled a large number of cultivators to live together in compact sites. In the words of Demangeon[6] the compact settlement "will be found, as an ancient feature, chiefly on lands which were fertile from the beginning."

Comparative Lack of Surface Water and Deep Water Table

In the Ganges Valley the relation between the types of settlements and the nature of rainfall and water supply is considerable. With the lower rainfall in the western part of the valley and on the Bundelkhand, surface water in the form of lakes and ponds is uncommon. The village pond, which is usually near the inhabited site, supplies water for irrigation and affords pasture on its margins. The pasture is utilized in common by all the inhabitants of the village. The pond or tank and its meadow bind inhabitants together in a compact settlement.

[6] A. Demangeon, "Agricultural System and Schemes of Distribution of Population in Western Europe," *The Geographical Teacher,* XIII (1925–26) : 199–205.

In the Ganges Plain masonry wells are the main source of domestic water supply and dwellings are built round them in the form of villages or hamlets. In the areas of deep water table, however, owing to the difficulty and cost of construction, masonry wells are infrequent. The population clusters is compact villages around the water source. In the zones of high water table, where wells are more numerous because they can be cheaply constructed wherever the need arises, the population need not concentrate near one central site and it is likely to spread into several outlying hamlets in the *mauza*.

The compactness of settlements in the Trans-Jumna Plain is thus partly due to the fact that this area lies in the zone of the deepest water table in the Ganges Plain. In much of the Doab also, the water table appears to have been much deeper before the advent of the canals than it is now. For example, about 1865, the average water table depth in Bulandshahr district was some 80 feet below the surface.[7] Now it is probably not deeper than 30 feet. The rise of water table in the Doab is a comparatively recent phenomenon and does not appear to have modified the original compactness of settlements.

Lack of masonry wells in Bundelkhand is combined with a quick run-off and restricted occurrence of natural sheets of water in the form of ponds. The lack of water in the *mauza* is very strongly manifested in the development of compact settlements. "The collective building of dams and irrigation channels for the storage and distribution of rain water and the construction of tanks for artificial irrigation have promoted the evolution of compact villages."[8]

Cooperation in Agriculture

It has been asserted[9] that communal cultivation was prevalent in the Ganges Valley in the past. Thus Mukerjee regards intensive farming with a fixed routine of cropping necessitating a common agricultural routine and collective management of pastures and distribution of water supply, to have "succeeded an earlier regime of collective ownership and periodic redistribution of holdings, village groves and meadows."[10] According to Demangeon "the compact village may be held to imply the existence, at least at the origin, of some form of communal cultivation."[11] Whether communal cultivation existed in the past or not, there does exist at present a considerable extent of mutual cooperation in agricultural activities. Wells, tanks or ponds, and pastures and similar land, usually rent-free, are regarded as common properties of the inhabitants. Agricultural implements, like ploughs, spades, sickles, and carts, and draught cattle are frequently exchanged or borrowed. When agricultural labor is scarce many cultivators form a team for digging, ploughing or

[7] *District Gazetteer Bulandshahr*, London, 1903, p. 42.

[8] Radhakamal Mukerjee, *Man and His Habitation*, London, 1940, p. 63–64.

[9] *Ibid.*, Chapter II, pp. 58–90, and *Land Problems of India* by the same author, London, 1933, Chapter II, pp. 13–28.

[10] Radhakamal Mukerjee, *Man and His Habitation*, London, 1940, p. 61.

[11] A. Demangeon, *op. cit.*

harvesting, and working in the fields of the partners in turn. Seeds and fodder are usually borrowed. Thus a host of collective habits have worked as binding forces in compact settlements.

Fragmentation of Holdings

The holdings of a peasant are distributed over the *mauza* in fragmented parcels of diverse size and fertility. The most fertile, heavily manured, and irrigated land surrounds the village. Beyond this lies another zone given over to the chief food crops and irrigated from wells or canals. An outermost zone, the poorest in fertility, is used for dry cultivation, usually millets and fodder crops. (This pattern is replaced in the eastern districts by one in which the outermost block of land is low lying and wet, and is used as paddy). The cultivator usually has one strip or more in each soil zone. While the scattered field system equalizes opportunities for all, its successful utilization is closely related to the centralizing effect of the compact village. "All paths and tracks across the fields, which for each cultivator lie scattered like autumn leaves, lead to the village that is the meeting ground of all."[12] Residing in the central cluster, the villager is at a minimum economic distance from his scattered fields. The transport of plough, cattle, and carts to and from the scattered plots has fostered compact settlements.

Clan Solidarity

"In the United Provinces of Agra and Oudh, the village communities are founded mostly by agricultural tribes, clans and castes forming close communities. . . . In Oudh (Fig. 1), however, the influence of *rajas* (chiefs) and *thakurs* (a proprietary caste) has reduced the village communities to a subordinate position."[13] Commenting on the size of the *mauzas,* Baillie observed that "in the western (Meerut, Agra, Rohilkhand, and Allahabad divisions) 'villages' the soil is in general owned by strong coparcenary bodies of the peasant-proprietor type all assisting in the cultivation or management of the much subdivided 'village'."[14] Such coparcenary bodies are the *jats, gujars,* and *thakurs* whose clan solidarity has held them together on a compact site. The *jats* are practically confined[15] to the upper and Middle Doab, the west Trans-Jumna Plain, and the Ramganga-Ganges Doab. The *gujars* are most numerous in the Upper Doab and the Ramganga-Ganges Interfluve, while the *thakurs* are very common in Bundelkhand.

Social and Economic Bonds.

Apart from cooperation in agriculture there is much social and economic interdependence among the inhabitants of a village. The division of labour which is

[12] Radhakamal Mukerjee, *op. cit.,* p. 62.

[13] Radhakamal Mukerjee, *Land Problems of India,* London, 1933, p. 18. See also B. H. Baden-Powell, *The Indian Village Community,* London, 1896, Chapter VI, pp. 225–287.

[14] D. C. Baillie, *Census of India,* 1891, Vol. XVI. *The North-Western Provinces and Oudh,* 1894, p. 103.

[15] A. C. Turner, *Census of India, 1931, U.P. Vol. XVIII, Pt. II, Tables,* 1933: 499–548.

one of the features of the caste system affords certain facilities to the occupants of a compact settlement. The presence of landless labourers, artisans, tenants, traders, and priests tends to maintain the self-sufficiency and solidarity of the village. Though the 'panchayat' (council of five) has lost much of its authority (now it is being enforced by government), people of lower caste still maintain this organization which exercises a considerable degree of influence over their social life. Among the higher castes, it was recently usually non-existent and landlordism had greatly reduced its influence. The social gatherings in the center of the village usually under some shady tree or near the temple; the mutual rejoicings on festivals; the gathering of neighbours after the day's work near the well in summer and round the fire in winter when tales are told and talks of fields and crops exchanged; all these have contributed their influence in the direction of compact settlements.

The peasants with no field work for some months in the year engage in cottage industries. Such subsidiary occupations flourish well in compact settlements. The closely-knit village is a convenient center for the itinerant small trader who buys the surplus grain, and often supplies the village with cloth, kerosene oil, yarn, utensils, and other petty requirements. The presence of the money-lender and the quack is also a centripetal force.

Religion and Superstition

There are strong superstitions about sites among all castes. A new site for a house is avoided as far as possible because of the fear that it may prove inauspicious. Houses can be built on a new site only after the sanction of the priest has been obtained. Village gods are supposed to reside on the outskirts of the village. "The 'deohar' or village gods form a very distinct group, to whose honour in almost every village, petty offerings are made at appointed seasons at the mounds (*than*) sacred to each in almost every village in the Province."[16] A villager usually does not dare cross the "protected jurisdiction." Though the growth of education is overcoming this superstition most people still retain a varying degree of allegiance to these godlings. This is an important factor contributing to the compactness of settlements. Moreover, he ancestral site of a house is usually regarded as sacred unless the family is in decay. Extension of a settlement on the south or west is also forbidden, the two directions being considered of ill omen.

State of Security in the Past

The nature of security in the past seems to have a very important influence on settlement types. While certain parts of the state have been associated with the movement of armies, recurrent battles, and incursions of marauders, others by their relative remoteness have, comparatively speaking, escaped such disturbances. Obviously in the areas of frequent troubles villagers aimed at defense and lived in compact settlements. In order to appreciate the geographical extent of such troubles

[16] D. C. Baillie, *op. cit.*, p. 223.

and the influence of the security factor on settlements we may cast a brief glance at the main disturbances in the history[17] of the State.

After the establishment of the Indo-Aryans (*c.* 1,000 B.C.), the first great battle —Mahabharatha—is supposed to have been fought at Hastinapur (now believed to be in Meerut district in the Doab). The next main disturbance after the reign of Asoka was experienced at the hands of the "Sakas," or Scythians, who advanced from the west as far as Muttra. The province enjoyed peace during the days of the Guptas of Bihar (fourth to fifth century A.D.), but this was followed by a disturbed period when the White Huns, coming from Central Asia, fought with the Guptas and other petty chiefs. The subsequent four centuries were relatively free from foreign incursions till Mahmud of Ghazni invaded the Doab in the beginning of the eleventh century plundering Bulandshahr, Muttra, and Kanauj. Subsequently Ghori defeated Jaichand of Kanauj (1194). Budaun and Ajodhya were made the seats of his governors during a following period of unrest. "Bundelkhand had not been subdued and the first half of the twelfth century was a time of war in most parts of the Provinces."[18] During the succeeding two centuries the province enjoyed comparative peace under the Muslim Kings of Delhi till Timur invaded Meerut division in 1339. The fifteenth century was a period of continued disturbances in the Doab, Rohilkhand, Bundelkhand, and Jaunpur.[19] This was followed by trouble during the early days of Akbar's rule (1556–1605), after which the province entered a period of relative peace which was to last for a century and a half.

The disturbances that took place after the death of Aurangzeb (1707 A.D.) were frequent and may be deemed recent. Their influence on the nature of settlements is important. Apart from the numerous battles and the movement of troops, there were recurrent activities by armed bands and looters. During the first half of the eighteenth century the Sikhs invaded the Upper Doab, the Jats harried the country west of the Jumna, and the Marathas held western Bundelkhand.

With the growing weakness of the Mughals new states began to be formed within the Uttar Pradesh, the chief among them being Oudh, Farrukhabad, and Hohilkhand. The British, who were advancing from the east along the Ganges, defeated the allies (Shah Alam and Shujauddaulah) at Buxar (1764) and again overcame the Nawab (in Cawnpore district) who had joined the Marathas. In the meantime the Sikhs, Jats, and Marathas continued to raid the Delhi, Agra, and present Meerut and Rohilkhand divisions.

When the British troops came to guard the Oudh frontiers the Marathas were forced to leave Rohilkhand, the Doab, and Allahabad territory. The Jats were driven out of Aligarh, Muttra, and Agra by the emperor, but the yearly incursions of Sikhs grew more and more serious. Moreover, the Marathas continued to grow in power and captured Agra, Muttra, and Northern Doab (1787). But the influence

[17] The historical facts summarised in the following paragraphs have been derived mainly from the *Imperial Gazetteer of India. Provincial series, U.P.* (*1*), Calcutta, 1908: 17–32.

[18] *Imperial Gazetteer of India, U.P. Vol. I*, p. 22.

[19] *Imperial Gazetter of India, U.P. Vol. I*, p. 23.

of the India Company was rapidly growing and, within about 70 years, the whole province passed under its control. The old lawlessness, however, did not disappear quickly. Dacoity and "Thagi" was rife. The mutiny which broke out in Merrut aroused former chiefs who created trouble at Bareilly, Farrukhabad, Banda, Cawnpore, Jhansi, and Lucknow. Since then the chief fears of the villager have been robbers and communal strifes.

From what has been said above it is evident that the geographical extent of upheavals in the past has been varied. The area of maximum disturbance has been the Upper Doab and the tract west of the Jumna. The rest of the Doab, Bundelkhand, and Rohilkhand come next in order of insecurity. From the examination of the chronicles it is evident that east of Rohilkhand and north of the Ganges the area has been relatively peaceful.

The battles and troop movements meant a danger to the peasants in the form of the trampling of crops, looting of property and cattle, and loss of honour and life. Villagers congregated in compact settlements often surrounded with mud walls round the fortress or mansion of the local chief or landlord so that they might defend themselves against vagrants from armies. The more frequent danger was from armed bands of Jats, Sikhs, and Marathas who are said to have plundered indiscriminately all villages that lay in their way. "All was fish that came to a Maratha net, and the smallest cultivator was not below the notice of their plunderers."[20] The influence of these marauders of a comparatively recent time is more important that the distant events of the past and is manifested in the compact settlements which are most characteristically developed in the Upper Doab, Trans-Jumna Plain West, and Bundelkhand. Other areas, like Rohilkhand and Middle and lower Doab, which suffered less from the looters, have smaller agglomerations.

FACTORS WHICH HAVE CONTRIBUTED TO THE SPREADING OR FRAGMENTATION OF SETTLEMENTS

We have noticed above the causes accounting in various degrees for the compacting of settlements. There are factors, however, both physical and cultural which have operated in the opposite direction, leading to the development of hamlets or the break-up of the village into fragments in the eastern districts of the province (Fig. 4.). Let us examine these factors briefly.

Abundance of Surface Water and High Water Table.

The greater amount of rainfall in the east results in a high water table east of the Ganges. Surface water in the form of ponds and lakes is relatively plentiful. The density of masonry wells which can be more easily and cheaply constructed in any part of the *mauzas* appears also to be high in the eastern districts of high water table. The frequency of the sources of water (wells and other water forms) in the *mauza* has thus obviated to a considerable extent the need for clustering in

[20] D. C. Baillie, *op. cit.*, p. 103.

a compact central site and has contributed to the spread of population to outlying hamlets.

Floods

Floods are of more frequent occurrence in the eastern districts because of the greater rainfall and because of the decrease in the gradient of river channels. The Gumti is often in spate in its lower course; channels are lacking in the large area it drains. Similarly, the Trans-Gogra Plain is often flooded by the Rapti, Sarda, and the Gogra. Thus in the eastern districts a considerable area may be inundated during years of exceptional floods as in 1938. Only elevated land in a *mauza* remains above water. All the inhabitants of a *mauza* in this densely populated tract cannot be accommodated on one small site, consequently, they use most of whatever available elevated blocks there may be. Although these elevations are only a few feet higher than the surrounding area they are sufficiently high to assure good drainage and possibly to escape in years of heavy floods.

This almost imperceptible unevenness of levels is associated with the process of alluvial formation of the plain. It is aided artificially, for once a site is occupied it continues to rise by the accumulation of debris.

Usar Soils

There is considerable relation between *usar* soils (Fig. 2) and hamletted settlement. The main zones containing patches of *usar,* occur in the Middle and Lower Doab and the central districts of the Ganges-Gogra Doab. The actual area affected is known to be 2 to 3 million acres. One of the main characteristics of the *usar* is that it occurs interspersed with highly cultivated land. *Usar* rarely occurs in sandy soils and is confined to loams and retentive clay. The salts (sodium salts—chlorides, sulphates, and carbonates) present in solution in ground water are washed down toward the water table during the periods of monsoon rainfall. During the intervening dry-weather periods, excessive evaporation takes place and draws the solution to the surface. The salts are precipitated as a white incrustation. Low gradient (under one foot per mile) and lower level of the central tracts of the interfluves as compared to the river-side uplands result in poor underground and surface drainage, waterlogging, and a high water table. This brings "the capillary fringe of the ground water within the influence of surface evaporation." This condition has helped in the formation of *usar* in the zones noted above.

The *usar* soil is almost entirely unproductive. It forms patches of comparatively low-lying, bare or grassy wastes, often containing large lakes in the center, which break the continuity of cultivation. The patches of waterlogged, uncultivable, uninhabited *usar* soil thus leads to fragmentation of cultivation in a *mauza* into several parcels, in each of which one may see a hamlet.

Low Agricultural Castes and Caste Hierarchy

In Oudh and Eastern Uttar Pradesh the proportion of low agricultural castes[21] is higher than in the west. Of these the more important castes viz., the Kurmis,

[21] A. C. Turner, *Census of India, 1931, U.P. Vol. XVII, Pt. II, Tables,* (1933), pp. 499–548.

Koeris, Bhars Muraos, who are thoroughbreds of the soil, show their influence on settlements by their agricultural habits.

The Koeris and Muraos, the vegetable gardeners, whose cultivation is by spade and hand labour rather than by plow, are engaged in "intensive, meticulous exploitation of the land."[22] While Koeris are roughly confined to the Benares and Gorakhpur divisions, Muraos are most numerous in Oudh. Owing to the attention demanded by their valuable crops, they often build their hamlets in their fields near the well. The Kurmis, one of the most numerous castes, are practically absent from the Doab and the Trans-Jumna Plain West (*i.e.* West of the Chambal-Jumna confluence), but are found in the rest of the Ganges Valley especially east of the river (Ganges). They are one of those castes most honestly devoted to the fields, the preservation of their fertility and productivity. Occupying the second position from the bottom in the Hindu caste hierarchy[23] they enjoy no enviable position in village society. They are not reluctant to leave the main site and settle near outlying plots. Thus they have contributed to the multiplication of the outlying hamlets in the area where they are most numerous. The Ahirs, another numerous caste whose geographical distribution is roughly coterminous with that of the Kurmis, are devoted mainly to cattle rearing and dealing in milk and *ghee* (clarified butter). In their need for grazing ground and plenty of water for cattle, they often build outlying hamlets in *khadars,* near moist grassy depressions or ponds and lakes.

Apart from these agricultural castes there are the untouchables, the Chamars, Pasis, and Doms who rarely possess land, who cannot draw water from the village wells, and who occupy the lowest position in rural society. The Pasis and Doms are most numerous in the areas of fragmented settlements. They live in a separate hamlet "at the outskirts of the village or sometimes even entirely segregated from it and possessing its own tanks, wells, and boundary gods."[24] The Chamars are present throughout the Ganges Valley, but their untouchability is less rigid in the west. Thus, the security factor and the difficulty and cost of constructing wells have kept them in one corner of the village in the western districts though of course, in a separate ward. East of the Ganges where caste bias is stronger, the Chamars usually live in a separate hamlet.

The Influence of Land Tenures

As noted earlier the land in the Doab is mostly owned by coparcenaries who reside in the village and are devoted to cultivation. In the east, however, most of the ground is owned by a few privileged *taluquadars*[25] and landlords[26] whose gradual usurpation of the common pastures and village wastes and whose absenteeism led to a deterioration of the village collectivism and economic welfare. The growing

[22] Radhakamal Mukerjee, *Man and His Habitation,* London, 1940, p. 71.
[23] Brahman-Kshatriya-Vaishya-Shudra.
[24] Radhakamal Mukerjee, *Man and His Habitation,* London, 1940, p. 104.
[25] Owners of *taluquas,* or big estates.
[26] D. C. Baillie, *op. cit.,* p. 103.

power of the landlord in Oudh and the permanent settlement in Benares Division eclipsed the authority of the *panchayat*.

There is a considerable relation between the proportion of landless labourers and fragmentation of settlements. In the Doab, and Bundelkhand—the zones of strife—historical and other factors have preserved the compactness of the village. In the east, however, especially in the eastern districts of the Ganges–Gogra Doab and the Trans-Gogra Plain, a high proportion of agricultural labourers in the whole population is related to the fragmentation of rural settlements. This is because the agricultural labourers, belonging usually to the lower castes, are compelled by landlords or subletting tenants to settle on their fields or in their groves as well as to look after them. The proportion of agricultural labourers has increased in the Middle and Lower Ganges–Gogra Doab and Trans-Gogra Plain because the average holding[27] (incidence of cultivated land per cultivator and his family) is the smallest (4.3–4.7 acres) in this area. Subdivisions of holdings by the law of inheritance and the growth of population have reduced petty tenants to the status of landless labourers.

The fragmentation of settlements also results from the frequent desire of the landlord to settle near his holdings and gather round him a number of agricultural labourers bound to him by loan or by cultivable plot given in return for services rendered.

Security

We have seen that the area roughly east and north of the Ganges except Rohilkhand (Fig. 1) enjoyed comparative peace during all times in history. It was also relatively out of reach of the looting bands of Sikhs, Jats, and Marathas. British influence came to the eastern parts of the province. After the defeat of Shujauddaulah (1764) by the British, the Nawab's territory was gradually drawn under British protection. British troops were sent to guard the Oudh frontier in 1773 against Marathas. In 1775 Asafuddaulah made a treaty with the British by which the latter obtained sovereignity over most of the Benares Division. Later the decline of the Oudh rulers led to a further growth of British influence. Thus it is the eastern areas which have enjoyed a longer period of security in the recent past than the western districts which remained harassed by the Marathas, Jats, and Sikhs. The feeling of security has helped the growth of hamlets near fields where the cultivators can pay better attention to their crops. "Their simple huts can run up in a few weeks on any spot which is sufficiently elevated above the rain floods and their almost only object is to be as near as possible to the fields they cultivate."[28]

[27] A. C. Turner, *Census of India, 1931, U.P. Report*, p. 45. The holdings 4.3 and 4.7 refer respectively to the (1) Sub-Himalaya East and (2) Indo-Gangetic Plain, East meaning (1) Gorakhpur, Basti, Gonda, Bahraich and (2) Benares, Jaunpur, Ghazipir, Bellia and Azamgarh districts respectively (See Fig. 1).

[28] B. H. Baden-Powell, *The Indian Village Community*, London, 1896, p. 71.

NATURE AND CAUSES OF SETTLEMENT TYPES IN VARIOUS TRACTS

Compact Settlements

The Upper Doab

The compactness of settlements is most perfectly developed in the Upper Doab (Saharanpur, Muzaffarnagar, Meerut, and Bulandshar districts). All the houses of a *mauza* are piled together in one large central agglomeration (Fig. 5). While the monotony of relief, uniform fertility of soil, the nucleating force of the well, the efforts of coparcenary proprietors to keep the *mauza* intact, and the clan solidarity of Rajputs, Jats, and Gujars have all been operative, the past insecurity in this zone of strife has probably been one of the most important factors in the development of such compact villages.

In the Middle and Lower Doab compact villages are the characteristic settlements, but they are smaller than in the Upper Doab and the inter-village distance is shorter. Though the area was raided by the Marathas it was relatively aloof from the incursions of the Sikhs and Jats during the eighteenth and nineteenth centuries.

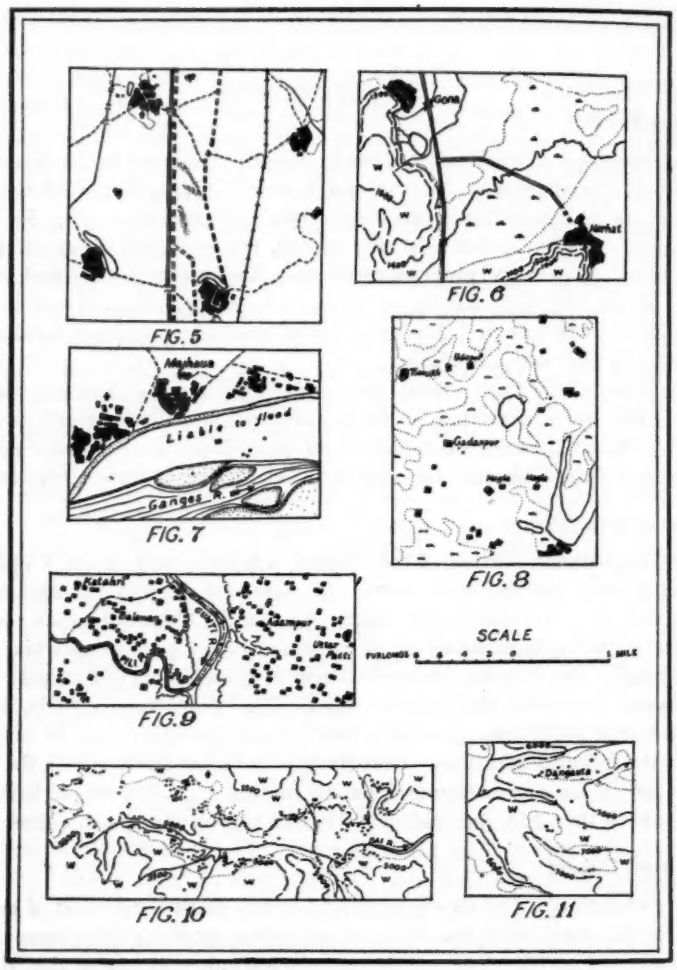
The Trans-Jumna Plain

The Trans-Jumna portion of the Muttra district is akin to the Upper Doab in respect of large compact settlements. In Agra and Etawah the agglomeration is similar to that on the north of the river. East of the Chambal-Jumna confluence almost half of the agglomerations are as large as in the Upper Doab while the rest are very small. The distance between villages is considerable and usually there is one settlement for every three square miles. The Trans-Jumna Plain, lying on the other side of the barrier (Jumna), was more frequently raided by marauders, especially the Jats and Marathas. Scarcity of water is nowhere else in the Ganges Plain so strong an agglomerating force as in this tract. Need of building on elevated sites in the sticky *mar* (black soil) is another cause of compactness.

Bundelkhand Upland

The relief here is not so strong as to lead to any marked diffusion of cultivated land. On the other hand the hills, by affording strong points, have fostered agglomeration (Fig. 6). The area was disturbed not only under the Marathas, but by the frequent feuds between the Bundela[29] chiefs and the critical position of the tract, between the kingdoms of Northern Hindustan and Peninsular India, also made self-defense of great importance to the village. A large number of the villages are the former strongholds of local chieftans who gathered the peasantry round their forts (now ruined) and afforded protection from opponents. We have already noticed the lack of water and need of concentration near tanks and river banks.

[29] A Rajput clan which ruled over parts of Central India and the Trans-Jumma portion of the Uttar Pradesh during 1680–1791 A.D.



The Upper Ganges–Gogra Doab

Here too the settlements are compact with the main difference from the Upper Doab that villages are smaller and lie closer together. The small size is related to the process of sub-division of larger *mauzas* into smaller ones and the development of newer villages in them. Though there are certain factors, such as the high water table, heavy rainfall, and the existence of the low agricultural castes, Kurmis and Muraos, which should have fostered the development of hamlets, the insecurity of the region (Rohilkhand) seems to be one of the main reasons for agglomerated settlements.

The Tarai

Curiously enough, settlements in the Tarai are compact. Certain conditions here, such as relative security in the past, plenty of water, and comparatively recent occupation of the area, should have fostered the developmnt of hamlets. Yet all the inhabitants of a *mauza* are concentrated in a central site. Almost regular inundation during rains appears to have caused nucleation rather than spreading. The small uplands available in a *mauza* are sufficient to accommodate all its inhabitants in this less densely peopled tract. The malarious, low-lying paddy fields occur in

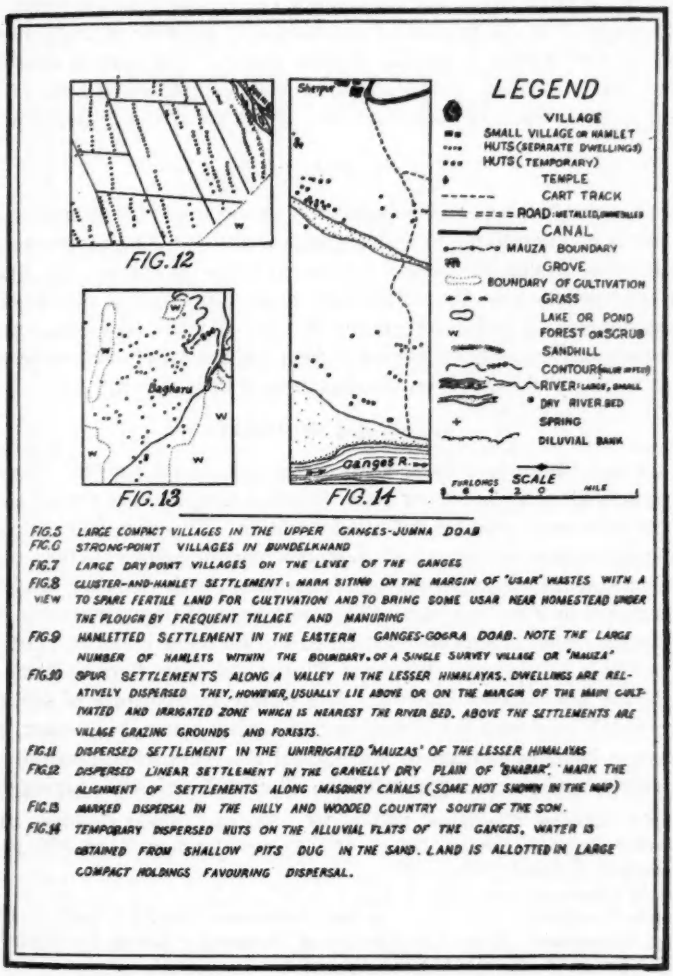


FIG.5 LARGE COMPACT VILLAGES IN THE UPPER GANGES-JUMNA DOAB
FIG.6 STRONG-POINT VILLAGES IN BUNDELKHAND
FIG.7 LARGE DAY-POINT VILLAGES ON THE LEVEE OF THE GANGES
FIG.8 CLUSTER-AND-HAMLET SETTLEMENT : MARK SITING ON THE MARGIN OF 'USAR' WASTES WITH A VIEW TO SPARE FERTILE LAND FOR CULTIVATION AND TO BRING SOME USAR NEAR HOMESTEAD UNDER THE PLOUGH BY FREQUENT TILLAGE AND MANURING
FIG.9 HAMLETTED SETTLEMENT IN THE EASTERN GANGES-GOGRA DOAB. NOTE THE LARGE NUMBER OF HAMLETS WITHIN THE BOUNDARY OF A SINGLE SURVEY VILLAGE OR 'MAUZA'
FIG.10 SPUR SETTLEMENTS ALONG A VALLEY IN THE LESSER HIMALAYAS. DWELLINGS ARE RELATIVELY DISPERSED THEY, HOWEVER, USUALLY LIE ABOVE OR ON THE MARGIN OF THE MAIN CULTIVATED AND IRRIGATED ZONE WHICH IS NEAREST THE RIVER BED. ABOVE THE SETTLEMENTS ARE VILLAGE GRAZING GROUNDS AND FORESTS.
FIG.11 DISPERSED SETTLEMENT IN THE UNIRRIGATED 'MAUZAS' OF THE LESSER HIMALAYAS
FIG.12 DISPERSED LINEAR SETTLEMENT IN THE GRAVELLY DRY PLAIN OF 'BHABAR'. MARK THE ALIGNMENT OF SETTLEMENTS ALONG MASONRY CANALS (SOME NOT SHOWN IN THE MAP)
FIG.13 MARKED DISPERSAL IN THE HILLY AND WOODED COUNTRY SOUTH OF THE SON.
FIG.14 TEMPORARY DISPERSED HUTS ON THE ALLUVIAL FLATS OF THE GANGES. WATER IS OBTAINED FROM SHALLOW PITS DUG IN THE SAND. LAND IS ALLOTTED IN LARGE COMPACT HOLDINGS FAVOURING DISPERSAL.

continuous expanses and are too damp and unhealthy to afford sites for hamlets. "The bad characters living just across the border in Nepal territory are still troublesome and organized dacoity is far from uncommon."[30] The proximity of the Nepal border encourages frequent robberies and thefts as the criminals cross over to the other State and escape punishment. The presence of thick sal (shorea iolusta) forests affords easy refuge to such criminals as well as being the home of many wild animals. All these causes have fostered nucleation.

The Levees

Levees of the large rivers, like the Ganges, Gogra, and Rapti, are tracts of compact settlements (Fig. 7), presenting a constrast in the zone of fragmented settlements. The compactness is due to physical causes. The narrow elevated space above flood-level provided by these uplands and the nucleating force of the masonry well in these tracts of very deep water table are the main causes of concentration.

Cluster and Hamlet Type

In this intermediate type, the population is neither spread in numerous detached hamlets nor is it concentrated in a single agglomeration. The occurrence of a few outlying hamlets around the central cluster is almost invariable (Fig. 8). Occupying an intermediate zone the settlements are an expression of the mingled influences of agglomerating and disintegrating factors. Many landowners, especially in Oudh, invest[31] small amounts of capital in founding hamlets, hoping to be repaid by the rise of rents and the extension of cultivation in their vicinity.

Fragmented Settlements

The average village consists of a main site and several hamlets. Some of the *mauzas* possess as many as fifty or sixty detached sites, and are treated as a single unit for the purpose of revenue and administration. This dispersion of population into numerous hamlets is unique and presents a marked contrast to the compactness of settlements in the other parts of the province. Each detached hamlet is frequently occupied by a distinct caste. The caste basis of fragmentation is very well indicated by the names of hamlets, the first part of the name indicates a caste and the second, means a hamlet, viz., *Chamran Purwa, Dhobian Purwa, Pande Purwa, Ahiran Purwa,* and *Lunian Purwa.*[32] The disintegrated nature of settlements is shown very well in Figure 9. Abundance of surface water, high water table, the caste factor, a large proportion of agricultural labourers and tenants-at-will, and relative security and peace in the past have all contributed with varying degree to

[30] *District Gazetteer, Gorakhpur,* 1909, p. 156. See also *District Gazetteer, Basti,* 1907, p. 127; *District Gazetteer, Pilibhit,* 1909, p. 131; *District Gazetteer, Kheri,* 1905, p. 121; and *District Gazetteer, Bahraich,* 1903, p. 107.

[31] *District Gazetteer, Unao,* 1903, p. 12.

[32] Camran P.—Hamlet of Chamars (an untouchable caste working in leather). Dhobian P.—Hamlet of Washermen. Pande P.—(a section of Brahmins). Ahiran P.—Hamlet of Ahirs (cowherds). Lunian P.—Hamlet of Earth-diggers.

the spread of population into separate hamlets. Easy and cheap construction of masonry wells has acted as an important centrifugal force. In some cases[33] the holders of proprietary and under-proprietary tenures have founded small hamlets on their holdings.

Dispersed Settlements

The Lesser Himalayas

The Lesser Himalayas are the largest tract with a more or less dispersed settlement. Here physical factors, rather than cultural, have been dominant.

Varying topography, different elevations, and slopes have determined the habitability of a site. Level ground is uncommon and, where it occurs, it exists only in small patches. The marked slopes of spurs and ridges restrict the extent of any settlements that can be built on them. The low-lying, relatively flat alluvium near river beds sometimes offers a chance for agglomeration, but the steamy, hot summer of the valleys and their more profitable use as paddy lands discourages nucleation. Not only the depth and fertility of the soil and its moisture-retaining capacity, but also the extent of its surface depend on the gradient of slopes. In this country of slopes, therefore, large areas of fertile soil are absent. Forests are by no means continuous. Some extensive patches may cover a series of ridges with only very small clearings here and there, but usually the trees are confined to the upper parts of ridges with occasional patches extending down the slopes. The distribution of available water is also uneven. Nowhere do springs exist in groups conducive to agglomeration. There are, on the other hand, dispersed springs supplying water only to a few dwellings around them. Land belonging to a *mauza* is limited in its productivity and cannot support a large agglomeration. The difficulty of movement on the slopes also helps dispersal. Thus the dissemination of settlements in the area is intimately related to its physical character, "the whole aspect of which leads to a diffusion of resources—arable land, water, and natural sites with pleasant exposures."[34]

"The scanty areas available for cultivation are separated by intervals so extensive and by paths so inaccessible that each cultivator must live on his own lands, and in general their cottages are scattered all over the hillside."[35]

The proportion of tenants-at-will is negligible. Most of the cultivated land is owned by proprietors or tenants who have occupancy rights in the soil. People are, therefore, free to build their dwellings anywhere on their holdings. The proverbial honesty of the hillman also obviates the need of clustering. People are "very law-abiding"[36] and most of the thieves in local jails are those who belong to the Ganges Valley and have committed thefts in the submontane tracts of the Himalayan districts.

[33] *District Gazetteer, Sultanpur*, 1903, p. 14.

[34] Finch and Trewartha, *Elements of Geography, Physical and Cultural*, New York, 1942, p. 641. N. B. The quotation referring to "hilly lands" is applicable to the Himalayan Region.

[35] Baillie, *op. cit.*, p. 105.

[36] *District Gazetteer, Nainital*, 1904, p. 169. See also *District Gazetteer, Almora*, 1911, p. 133, *District Gazetteer, Gahrwal*, 1910, p. 105, and *District Gazetteer, Dehra Dun*, 1911, p. 154.

The Lesser Himalayan settlements can be divided into three sub-types.

(1) By far the largest in number are the settlements in which each dwelling is located at a considerable distance from the others and in separate fields. These isolated homesteads in the case of irrigated *mauzas*, however, are not scattered over the whole cultivated area, but are located in an intermediate zone (Fig. 10) usually on a spur above the irrigated land in separate fields which are given dry cultivation. Each family possesses a garden or orchard and a field or two near the dwellings, the rest of its holdings being scattered in the zone of irrigated cultivation below. Near the houses and usually above them are long strips of grass, like village greens, on which the cattle graze in common. About a dozen separate dwellings may be scattered over 30 or 40 acres of land, while a similar area in the Gangetic Plain is occupied by the largest of villages where about 500 houses may be packed together. In the dispersed settlements of the *mauzas* without any irrigated lowland, dwellings are scattered over the entire arable area (Fig. 11), the holdings of each family lying round the homestead. The extreme case of dispersal, in which a single dwelling is the entire settlement, is frequently seen, especially in forested tracts where clearings are very small.

(2) The next most frequent type of settlement is a variant of the dispersed type. Dwellings are partly scattered in separate fields and partly grouped together. The clustered dwellings form a small hamlet often in rows of half a dozen houses and the scattered dwellings lie round the hamlet. The development of hamlets depends to a great extent on the availability of level ground.

(3) The least numerous class of settlements is that in which dwellings form one or more compact blocks and dispersed dwellings are scarce. They have come into existence where there is some centralizing force, such as a wide expanse of level ground, a well-drained alluvial cone, and the occurrence of the arable land in a compact block. Where one or more of these conditions obtain the few large and compact villages of the Lesser Himalayas may be seen.

There is no single part of the region to which any one of these types is confined. This is implied in the irregularity of relief we have just emphasised. While the dispersed settlement which is predominant in the region occurs in all parts, it is most common in the more wooded and rugged northern half and also on the foreslopes of the Himalayas. Smaller nucleations are more frequent in a central belt—less forested and more regularly cultivated country than other tracts in the Himalayas—running through all the Himalayan districts.

The Duns

Settlement in the Duns, Dehra and Kota (Fig. 2), are more or less disseminated. In most cases houses are scattered over fields, but in some especially large villages, there is a central nucleus. Such clusters are more noticeable in the older settlements near the town of Dehra. Even in the settlements where many small compact centers occur they do not include all the dwellings, a large number of houses being scattered in fields. The causes of dispersal are many. A large number of settle-

ments are relatively recent[37] subsequent to the construction of canals and the settlement of land by the British Government. Cultivation is broken into patches by the deep-bedded *raos* (torrents) and by patches of woodland. Here the centripetal force—the well—is almost entirely absent because the water table is very deep. The water point here is not a point, but a line in the form of a canal or river. This has also led to the scattering of houses along the sources of water.

The Siwalik Range

This range is mostly under forests and has few settlements. The majority of these are dispersed. Clearings are very small, and, because of the confused nature of the surface, their pattern is very irregular.

The Bhabar

Figure 12 shows the nature of dispersal in the Bhabar. The settlements indicated on the maps are the permanent habitations of the canal-irrigated areas. "In the long settled villages of the Bhabar [Fig. 3] each tenant has his homestead on his field by himself, generally a substantial building with a small yard or garden, a grainstore and a thrashing floor."[38] The grass and wattle huts of the immigrant from the hills, who settle in this zone during the winter, are also dispersed being "at a considerable distance from each other."[39] The causes of dissemination are more or less the same as in the Duns, viz., absence of wells, dangers of damage to crops by wild animals from the adjoining forests, and great attention to irrigation in a thirsty country. "The *gul* or watercourse runs as a rule down the centre of a 'village' and on either side are the fields which are generally of a larger size than in the southern districts; they are all parallel and straight, suited to the requirements of irrigation."[40] The large size of the fields and the nature of their arrangement along the canals are further causes of the scattered situation of the dwellings. The dispersed settlement of this tract is confined to the Nainital and Garhwal Bhabar, and its forested portion in Bijnor. In the deforested Bhabar of Saharanpur and Bijnor the dispersed settlements give place to the nucleated type, because there the physical character of Bhabar has been altered by long continuous cultivation.

The Khadar

We notice on Figure 4 small tracts with disseminated settlements in the riparian sections of the Ganges, Sarda, and Gogra valleys. Though the khadars of the rivers cover a larger area than the dispersed settlements, development of dispersed settlements has been retarted by factors mentioned above. Tendencies toward spreading are greater in the east. A relatively large part of the Gogra Khadar has

[37] At the time of Shore's settlement (1825), the Dehra Dun tahsil had only 156 "villages" (*District Gazetteer, Dehra Dun*, p. 129). In 1941 (*Census Table*) the *tahsil* contained 422 "villages."

[38] *District Gazetteer, Naini Tal*, 1904, p. 118.

[39] *Ibid.*

[40] *Ibid*, pp. 57–58.

disseminated huts. Settlements in the floodplains are associated with new alluvial fields allotted in compact holdings to peasants. Wild animals, especially blue bulls, are a great menace to the crops in these relatively lonely tracts. Non-masonry wells can be dug, sometimes near homesteads, owing to the mellowness of the soil and height of water table, or water can be derived from shallow pits dug in the beds of *nullah*. All the temporary thatch huts, which are portable, are dispersed (Fig. 14).

South-Eastern Uplands

There are two tracts in this region with dispersed settlements, the Sonpar (Fig. 13) and a narrow tract on the Vindhyan hills in South Banda. The dispersal in the Sonpar is often more marked than in the Lesser Himalayas with houses at a distance of 50 to 100 yards or so, scattered in the midst of cultivated fields. Where, however, valleys or basins are broad as in the Kon Basin or Son Valley dwellings may cluster into hamlets.

Here also the irregularity of relief and occurrence of forests have produced a scattered pattern of arable land. Water is scarce and is available only at scattered sources. Poor sandy soil does not permit intensive cultivation. Certain Central Indian Tribes, such as Agarias and Korwas, inhabiting this tract do not practise agriculture and reside in scattered dwellings in forest clearings. The area is still very much isolated and was more so in the past since it was away from the paths of invaders. The comparative honesty of the people has also helped dispersal in that there is no fear of robbers.[41]

The Great Himalayan Region

Our knowledge as regards the types of rural settlements in the Cis-Tibetan zone is meager. No large-scale maps of this region are available and the records are almost non-existent. Consequently we have left this tract blank on the map (Fig. 4) as a "zone of uncertainty." The physical nature of the area, however, appears to have contributed to the development of greater agglomeration than in the Lesser Himalayan region. Owing to the steepness of the upper slopes and the dangers of avalanches and landslides, the villages are generally built on small sites on the more or less level ground along valleys and on alluvial cones. The need for protecting the village, fields, and communications from avalanches by joint building of wooden and stone fencing, and afforesting slopes appears to have favored nucleation. The unevenness, however, of topography, where level ground is non-existent, and the nomadic habits of the people might have acted in the opposite direction.

[41] *District Gazetteer, Mirzapur*, 1911, p. 181.

A MAP OF FLYING WEATHER

GLENN CUNNINGHAM
University of California
Los Angeles

"FLYING Weather" is a term frequently encountered in aviation literature. Although it lacks a single, simple definition, the concept is of interest to the geographer as an immediate application of weather phenomena to such specific economic activities as commercial flying and the location of aircraft manufacturing plants. Likewise of interest to the geographer is the presentation of the distribution of flying weather, once it has been defined, in map form.

The definition of flying weather, presumably the weather in which one does or can fly, including taking off from and returning to the surface, involves answers to the questions "Who is doing the flying?" and "What is he flying?" Obviously the possibility of flying under various conditions of weather depends on the skill and experience of the pilot, the size and type of plane, and the variety of instruments with which the plane is equipped.

Many atmospheric elements are involved. Of prime importance is any condition affecting visibility: fog, cloudiness, heavy rain, snow, ice crystals, haze, smoke, and dust. Closely associated is ceiling, the distance from the surface to the lowest cloud layer reported as "broken clouds" or "overcast." In addition the flyer must reckon with hazards that accompany strong winds, electrical storms, hailstorms, and the presence of icing conditions at normal flying altitudes.

Even with the absence of the above conditions, excessive heat may influence the ease of take-off and hence the payload factor, especially for heavier planes. In the operation of jet planes in particular, high temperature and high relative humidity increase the runway length requirements. Similarly, longer take-off runs are required in the lighter air of higher altitudes. Thus elevation alone, regardless of local atmospheric conditions, must be recognized as a factor in evaluating the flying possibilities of any given locality.

It is at once apparent that flying weather requires the simultaneous consideration of many variable elements, some of them difficult or even impossible to measure. The numerous factors involved preclude the likelihood that any single station will provide the perfect set of conditions for flying. Desert areas, for example, may enjoy relative freedom from atmospheric moisture affecting visibility, but often at the price of excessive surface heat, high winds, and occasional dust storms.

A partial solution to the problem of differentiating flying weather may be found by employing various combinations of two of the more important elements, ceiling heights and visibilities. This has been done in *Classified Flying Weather for the United States,* a publication of the Weather Bureau.[1] As stated in the Introduction

[1] *Classified Flying Weather for the United States,* United States Weather Bureau, Division of Climatological and Hydrological Services, Aviation Section, Washington, 1946.

(p. ii), a summarization of either element independently fails to give the true picture. "Low ceilings and low visibilities may be co-existent, or either one present without the existence of the other." Thus it is essential to tabulate the percentage of time that each significant combination of these elements, or types of flying weather, has existed.

The Civil Aeronautics Administration has designated and used for some years, a combination of various ceiling and visibility values, defining the classfication of flying weather as "contact," "instrument," or "closed." Contact flying weather requires a ceiling of at least 1,000 feet and visibility of three miles or more. Instrument flying weather implies either element below the minimum required for contact flying, but a ceiling not below 500 feet *and* visibility of not less than one mile. Closed flying weather is that in which either the ceiling is below 500 feet or visibility is less than one mile.

Although these definitions frankly omit consideration of high winds, ice formation, and other conditions that the flyer can ill afford to neglect, they perhaps come as close as is currently possible to a significant classification of flying weather. The most frequently encountered obstacles, low ceiling and low visibility, are included whether they occur singly or together, and the results enable a ready comparison of conditions at two or more locations. The three-fold classification provides a rough indication of the flying possibilities for the specified period.

Classified Flying Weather for the United States presents tables for more than 400 airfield locations showing monthly and annual percentage frequencies of contact, instrument, and closed weather. It is these data that have been used in the compilation of the accompanying isopleth map (Fig. 1). The percentage frequencies of contact flying weather were plotted and the isopleths drawn in conformance. It is, then, a map of the annual percentage frequencies of that combination of ceiling and visibility conditions sufficiently favorable to be defined as contact flying weather.[2]

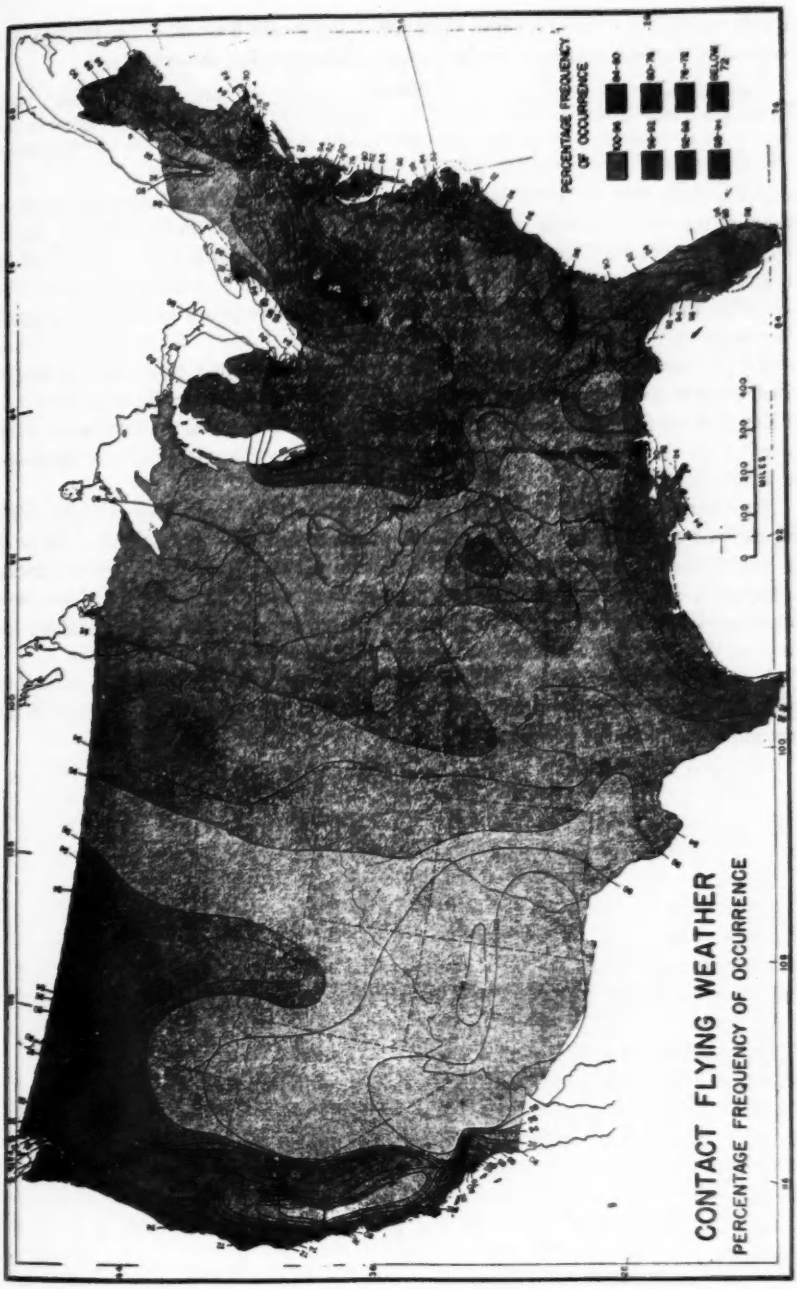
The primary source supplied data for 435 airfields. In many instances two or more fields were in the same vicinity, but altogether about 350 well distributed localities were represented. A second source, *Normal Flying Weather for the United States*,[3] provided data for an additional number of stations that proved useful in filling in some gaps, facilitating the necessary interpolation.[4]

A problem is met in the fact that both ceiling and visibility conditions can show

[2] The term *isopheng* is proposed for the specific isopleth that designates equivalence of contact flying weather conditions. It is derived from the Greek *iso*, equal, and *phengos*, light or brightness, and thus is a line connecting places experiencing "equal light" or "equal brightness" of atmospheric conditions; hence "equal flying weather."

[3] *Normal Flying Weather for the United States*, United States Weather Bureau, Statistics Division, and AAF Weather Service, Weather Control Division, Data Control Branch, New Orleans, 1945.

[4] Sources of data, especially those covering any length of time, are not abundant. The earliest investigations of the Weather Bureau were, of course, little concerned with flying conditions. As late as 1928 only four stations were making special airway observations. Today the number of stations exceeds 400, but only 300 or so have an unbroken 24 hour record for as long as ten years. *Normal Flying Weather for the United States*, Introduction.


CONTACT FLYING WEATHER
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extreme variability even over short distances. Benjamin Ratner, in the Introduction to *Classified Flying Weather for the United States* (p. iii), states it thus:

". . . . conditions in the same city but at different airports are often quite different. These differences are usually due to local terrain, i.e., proximity to bodies of water, changes in elevation, or even closeness to manufacturing centers, with resultant smoke. All of these factors should be considered in determining 'flying weather' for individual locations."

As an example, two airports in Pocatello, Idaho, record percentage frequencies of contact flying weather of 87 per cent and 96 per cent,[5] a difference probably due to local conditions alone. In this case the record most in line with neighboring localities was selected and the "erratic" discarded, a procedure that seems justifiable with the knowledge that the record for this station was only two years in length, compared to seven years for the other.

The purpose of the map is to provide a generalized picture of the distribution of flying weather over the country rather than detail for any specific location. It is felt that the resulting product is as representative of the actual conditions as is any isopleth map compiled from data coverage that is less than 100 per cent complete, and that is subject to the limitations of interval and scale.

The results introduce no startling irregularities. Instead, they conform fairly well to known conditions, such as those presented on the more familiar maps of fog frequencies, percentage of possible sunshine, and location of storm tracks. Topographic features and their effects are apparent where data provide a cross section of conditions as in the Sierra Nevada, but fail to appear in other instances, for example, the Colorado Rockies, perhaps only because no data are available.

With many shortcomings acknowledged, the map of flying weather is offered as a preliminary effort in the presentation of this particular type of information in the form most useful to the geographer.

[5] *Classified Flying Weather for the United States*, pp. 93, 94.

ABSTRACTS OF PAPERS PRESENTED AT THE 48TH ANNUAL MEETING OF THE ASSOCIATION, WASHINGTON, D. C., AUGUST 6–7, 1952

The Distribution of White Settlement in Kenya. DONALD R. PETTERSON.

In Kenya the white population has increased in numbers from 528 in 1901 to 29,660 in 1948, the date of the latest census. Over the greater portion of the territory the small, scattered, and temporary white settlement is a reflection of unattractive environmental, economic, and political factors. In the southwestern sector known as the White Highlands such factors as moderate temperatures, adequate rainfall, relatively level relief, fertile soils, scheduled transportation facilities, and a favorable Government policy have been attractive for the development of white settlement. 86.3% of the total European population is situated in this portion of Kenya. The probable future increases in the size of the white population will result in denser settlement in the White Highlands.

Early Chinese Settlement in Borneo. TSUEN-KUNG CHANG.

Description and interpretation of the development and distribution of the Chinese settlements on the northwest, west, and southeast coasts of Borneo prior to 1850, with special attention to their chief occupations, such as trade, agriculture, and mining. Factors of their progress and Chinese influence in Borneo are mentioned.

Patterns and Problems of Land Tenure in the Lesser Antilles: Example of Antigua. JOHN P. AUGELLI.

There is a growing controversy over the systems of land tenure and tenancy in the Lesser Antilles. On one side, an impoverished peasantry groping for the security, which they feel only land can give them, are demanding radical land reform. They insist upon a more equitable distribution of land, a liberalization of tenancy practices, and greater peasant participation in the production of commercial crops. On the other side, the estate group, fighting to retain the efficiency so important to the survival of a decadent plantation agriculture, point out that the commercial economy of the area is doomed unless production is kept to large efficient units. They agree to nominal reform, but they insist that only land which is not being effectively utilized be reallocated to the peasants.

This controversy over land tenure and land reform has been an important factor in the background of discontent which has characterized the Antilles in the last few decades. Like other regions of plantation agriculture, the clash between the large land-holders and the native labor element threatens to disrupt the entire socio-economic structure of the area. In this respect, the problems of land tenure in the Antilles are significant not only for the region itself, but also as an indicator of the forces at work wherever plantation agriculture exists in the tropics.

Most of the better land in Antigua had been alienated by plantations long before the bulk of the island's negro population had acquired the right through emancipation to own land. With the exception of the land settlement scheme which "is not impressive either in magnitude or achievement," the predominant systems of land tenure and tenancy are only slightly modified forms from those of pre-emancipation days. The result is a large landless peasantry which lives under constant economic distress, and which is becoming restive in its demands for land reform.

But such reform is far from easy. Among the more difficult questions which reform raises are: Should cane, the mainstay of Antigua's economy, be raised on estates or on peasant plots? Would the break up of estates and the redistribution of the land to the peasants raise the living standards and productive capacity of the island? Can estate and peasant agriculture exist and work side by side for the good of all the people? What constructive changes can be made in the patterns of land tenure which would give the peasant greater security, but which would not disrupt the efficient estate agriculture?

The Railway Pattern of Barbary. BENJAMIN E. THOMAS.

The railway net of French North Africa is isolated by the sea on the north and west and by the Sahara on the east and south. A long east–west line has northern branches to seaports and southern branches to the interior. In detail, however, Morocco has only standard gauge lines, Algeria has four different gauges, and Tunisia has standard gauge in the north and narrow gauge in the south.

The early railways of Algeria, in several gauges, ran from seaports to interior farmlands and mines. Because of hilly terrain and hasty construction there were many sharp curves and steep grades. These railways were connected by a standard gauge east–west line for political reasons, but economic and financial difficulties have retarded improvement of the older lines.

Tunisia was acquired by France during the 1880's. A standard gauge line in the north connected with the Algerian system, and narrow gauge lines in the south transported minerals and farm products to the east coast. These railways were eventually linked by a strategic coastal narrow-gauge north–south line.

France built narrow gauge military lines in Morocco between 1910 and 1920 to aid in the conquest of the country. International agreements prevented the construction of standard lines until after the First World War. The light military railroads were then removed. All present railways are of standard gauge.

During the depression of the 1930's the railways of North Africa suffered from decreased traffic and increased competition from motor vehicles. The "coordination" prohibited truck and bus competition with the major rail lines, but closed some branch railways in favor of motor transport.

During World War II, motor vehicles almost disappeared and rail traffic to the front in Tunisia was very heavy. The strategic weakness of having only one vulnerable coastal east–west railway was revealed. A few small changes were made in the railnet, but a second railway could not be justified economically. The major

flow of traffic is on the branch lines from the interior to the coast. The three Barbary States are similar in economic geography and have nothing to exchange with each other. Minerals and agricultural products are exported with a return flow of manufactured goods and food. An interior east–west highway, in addition to the coastal ones, is being constructed as a strategic measure.

American Inland Waterways: Traffic and General Transport Relations. DONALD J. PATTON.

American inland waterways have entered a new phase of use, marked by calculated use of barge transport for bulk commodities wherever water routes offer alternatives to overland shipment and time can be traded for lower shipping costs. Heaviest traffic densities on these waterways are associated with the northern Appalachian coal field and the Gulf Coast petroleum province, but most segments of the largely integrated system of deepened waterways carry a minimum of several million tons of highly specialized, predominantly long-haul traffic. The Gulf Intracoastal Waterway is beginning to have a far-reaching effect on the waterway system as a whole, due to its role of collecting traffic along the length of the Gulf Coast for shipment over the entire system.

Inland waterways are complementary to motor transport, and both competitive and complementary to rail and pipe line transport. Longer haul bulk traffic movements, particularly those over 300 miles in length, are gradually shifting from rail to barge wherever points of origin and destination are connected by waterways. Combination river–rail movements are increasing, reflecting cost differentials favoring water shipments for certain classes of freight. Pipe line–water carrier competition poses another situation in which each medium is in a superior competitive position relative to particular types of transport services.

The current volume of inland waterway transport is restricted sharply by inability of many potential shippers to reach the carriers. Further large-scale growth in barge traffic will depend on continued construction of riverside terminals and adoption of a larger series of adequately low combination river-rail tariffs.

The Highways of Mexico. DAVID W. LANTIS.

Mexico continues to experience a major social revolution in which her expanding highway network contributes an important part.

Highways were important to the Aztecs and the Mayas even in pre-conquest times. The Spanish likewise appreciated the need for adequate communications; however, highway construction varied according to the inclinations of the individual viceroy. The most adequate system of colonial roads existed in the central portion of the country, between Mexico (city) and its ports, and between the capital and the principal mining centers.

Highway improvement was limited during the first century of independence, although existing roads were generally maintained. During the latter nineteenth cen-

tury, some roads were constructed so as to permit movement of goods to and from the new rail lines.

Since 1925, an accelerated program of highway construction has materialized. By 1951, the federal highway system envisaged by a national congress in 1930 had been achieved.

The present pattern of federal highways reveals a concentration of roads in the central volcanic highlands. North of Mexico, D.F., there are now three separate links of the Inter-American Highway, linking the capital with the international border at Nogales, El Paso, and Laredo. Southeast of the capital, the Pan-American highway is a single link of paved road through Puebla, Oaxaca, and Tuxtla almost to the Guatemalan border. Trans-continental routes are limited, but construction of a trans-Isthmus of Tehuantepec superhighway and a Durango–Mazatlan road is taking place.

Highway utilization is increasing rapidly, although the number of vehicles is still limited. Truck traffic, especially short hauls, is expanding; heavy trucks, however, create a significant maintenance problem for the thin pavement surfaces. Highway maintenance, incidentally, is still poor, although it is improving. Bus routes now exist throughout the country. Highways are contributing to the elimination of isolation, the conquest of illiteracy, and raising of the standards of living. Increasing numbers of American tourists should tend to produce greater international understanding.

Manufacturing Regions of Norway. JEROME P. PICKARD.

The purpose of this study is to define and to describe the manufacturing regions of Norway. Norwegian manufacturing employed one-fifth of the labor force in 1950, and contributed one-third of the total value of gross national product.

The central southern part of Norway is a barren high mountain region of low productivity; population has concentrated in the surrounding valleys and lowlands, and along the coast. Seven distinct and separate manufacturing regions are located on an arc around the mountain core, extending from Mjøsa on the east, around the coast to Trondheim in the north. Nearly four-fifths of all manufacturing employment in Norway is in these seven regions, and the remainder is scattered in smaller centers which vary from the great industrial complex at Rjukan to small individual saws, grain mills, or furniture workshops employing only a few persons.

The Southeastern Norway region is the largest and most important; it is chiefly oriented to the home market though it has some major export industries. Each of the other six regions possesses a distinctive character of industrial development which is related to the location of population (labor supply and home market), active commercial development (capital and export markets), power development, transport, and raw materials (many of which are imported). The coastal orientation of manufacturing is pronounced, and will probably continue to increase as a result of the development of electric power transmission from the hydroelectric plants at power sites in the interior.

Industrial-Commercial Rehabilitation in Japan. HOWARD H. MARTIN.

Postwar rehabilitation of the Japanese economy began with the Five Year Plan of 1947. Accepting the food deficit as probably permanent, the Plan called for the restoration of light and heavy industry including shipbuilding, a modern merchant marine, and the expansion of overseas trade, all regarded as logical remedies for the imbalance between population and resources.

Steel-making, 8 million tons at its peak, is now cut off from the raw materials of Manchuria and North China; with longer assemblage, using ore and coal from U. S. sources, steel reached 4 million tons in 1952. Non-ferrous metals, machinery, and chemicals showed even higher recovery. Shipyards, restored to an 800,000 ton capacity, were fully employed for foreign and home account. The merchant marine, reduced from 6 to 1 million tons by 1945, registered 2.5 million tons of shipping in April, 1952. Factories, shipyards and repair plants are running full-time on Korean war orders.

The industrial-export program demands a steady flow of imports, including raw materials, power fuels, and equipment for factories and transport media. Iron ore, ferro-alloys, aluminum, coking coal, petroleum, chemicals, fertilizers, and wood-pulp are lacking or in short supply, as are heavy equipment, machine tools, and automotive vehicles. Textile fibers include 500,000 bales of wool imported mainly from Australia; raw cotton from the United States rose to 954,000 bales in 1951–52.

Controlled exports began in 1947, with restrictions gradually removed; in 1950 Japan regained its position as leading world textile exporter. In 1951 a trade fair was held in Seattle, 550 Japanese manufacturers and trade associations exhibiting a wide array of goods for export.

Present trade plans stress North America and Southeast Asia where new nations such as India, Pakistan, and Indonesia need machinery and equipment for their own industrialization. Despite limited fleets, many shipping firms and trading agencies are opening offices abroad and offering monthly sailings to selected ports. The planned economy for Japan's future is based on raising manufacture to high efficiency, importing materials and fuels freely, and using the modernized merchant marine in a concerted drive for foreign markets.

The Wood Pulp Industry of the Southeast. R. PAUL TERRELL.

The wood pulp industry of Southeastern United States is of geographic significance because it has been, with cotton textiles, a pacemaker of industrial development of the region, because expansion has been rapid recently, because the Southeast has approximately half the nation's pulp manufacturing capacity, and because the pulp industry promotes an efficient type of land use wisely adjusted to climate and to much of the soil and terrain of the region.

Southeastern pulp mills have been located largely in response to nearness to supply of wood, water supply, and rail transportation facilities. Many large mills are concentrated in and near sandy or other poor soil areas, better adapted to pine production than to agriculture, in an arc of coastal plain and outer Piedmont ex-

tending from Virginia through nothern Florida to eastern Louisiana. Other concentrations are based upon similar coastal plain soils and pines or mixed forests of northern Louisiana–southern Arkansas and pine woods of eastern Texas. Hilly lands of central and south Mississippi and rugged portions of the southern Appalachians provide hardwoods used by pulp mills of those districts. Although Savannah and Mobile are notable exceptions, most pulp mills are located in small towns rather than in major cities. Pulp mill odors, enormous water requirements, and high tax rates of metropolitan centers result in selection of rural or small town sites located on large streams.

Most Southeastern kraft pulp is used for the outer sheets of corrugated boxboard and for wrapping paper. Some is bleached for milk containers, and some is machine coated for magazine stock. Semichemical pulp is used for the corrugated portion of boxboard. Mechanical pulp is used in newsprint and building board. Soda pulp, from short fibred hardwoods makes smooth, but none too strong paper of book and bond types.

The pulp industry is the basis for rather large paperboard and construction materials industries. In most instances the paper or related pulp consuming industry is located on the same property as the pulp mill adjacent to the supply of raw material. Notable exceptions are the two dissolving grade pulp mills, which sell their product to manufacturers of rayon, cellophane, plastics, and explosives.

In the paper, emphasis is placed upon development of the industry and upon factors affecting location, particularly the pulpwood base.

The Westward Movement of Cheese Manufacturing Regions of the American Dairy Region. LOYAL DURAND, JR.

Theoretically the portion of a dairy region nearest urban markets produces market milk for the nearby cities; the next zone outward in the dairy region produces milk for condenseries; a more distant zone manufactures cheese; and the most removed portion of a dairy region manufactures butter. In the case of the American Dairy Region, the regions of cheese manufacture, throughout historical development, have in effect been on the outer edge of the dairy zone, but not in the most removed area (the butter district). This has resulted in a "westward movement" of cheese manufacture across the Dairy Region. In turn, the leading regions producing cheese have been (1) southern New England, (2) western Vermont–New York state–northwestern Pennsylvania–northeastern Ohio, (3) northeastern Illinois–southeastern Wisconsin, and (4) Wisconsin, excluding the extreme southeast. This westward transfer of cheese manufacture was largely initiated by New Englanders in their westward movement to New York and Ohio, and was continued by both New Englanders and New Yorkers in their westward movement to Michigan, northern Illinois, and southern Wisconsin. Economically, the westward movement has in effect been a "retreat" before the expanding urban milksheds of (1) the New England cities, (2) New York City and the urban centers of the mid-Atlantic seaboard, (3) the cities, at a later date, of the Lake Erie shorelands and of Detroit,

and (4) the Chicago and Milwaukee milksheds. Even now the industry is shifting westward in the Dairy Region: its direction of movement in Wisconsin is north and west, a "retreat" before both the growing urban milksheds and expanding condensery regions; it has expanded recently into former butter-manufacturing regions, both in western Wisconsin and in Minnesota, at the westward edge of the American Dairy Region. Beyond the contiguous Dairy Region an outlier of importance in the Tillamook Valley of coastal Oregon dates from 1874, and is oriented toward the markets of the Pacific Coast.

The importance of New Englanders in the westward movement of cheese manufacture to the Mohawk Valley of New York and the Western Reserve of Ohio was very pronounced. Specific localization of cheese manufacture in New York was strongly influenced by the Erie Canal. New Yorkers, in turn, were leading factors in the spread of cheese manufacture to Wisconsin.

Throughout different periods in the historical geography of cheese manufacture, the name connoting quality cheese has shifted westward. The formerly-famous Narragansett, Braintree, and Litchfield cheeses of New England were replaced in the "name-trade" by the Herkimer cheeses of New York, and these in turn by the present Wisconsin cheese and the Tillamook cheese of Oregon. All of these were or are regionally advertised names for the usual product—American cheddar cheese.

Industrial Foundations: A New Plant Location Factor. ALBERT S. CARLSON.

The Industrial Foundation, privately sponsored community corporation for assisting in the financing of industrial expansion and new plants, will effect important changes in the geographic pattern of factory location in the industrial regions of the Eastern U. S. and will alter the industrial structure of individual communities.

Economic geographic analysis of factory location factors must pay increasing attention to the fact that manufacturers of several hundred products such as small woolen and shoe plants, metal fabricators, plastic, electronic and electrical machinery concerns have a choice of locating in any one of several locations in Eastern U. S., because of the mature economic development of this area and the consequent levelling off of costs of transportation, power, and labor. Thus, community desire for new industry and establishment of an Industrial Foundation to finance such, assumes increasing importance as a future location factor.

The economic and geographic conditions encouraging this condition and actual examples are the theme of this paper.

The Brahmaputra Valley Region, Northeastern India: A Study Based in Part on Field Reconnaissance in 1945. HERMAN FRIIS.

Shortly before noon on a warm sunny day early in February 1945 our C-47 United States Army Air Force plane took off from the dusty Air Transport Command base situated in the right-angle turn of the Ganges where it spills onto the delta in Bengal Province. Twenty-six of us, Air Force military personnel, were

aboard the bucket-seat, gear-laden plane bound for duty in China by way of the "Hump" with a stop-over in Chabua far up the Brahmaputra Valley.

Our path of flight followed closely the tortuous channel of the Brahmaputra River. Late that afternoon we landed in Chabua, were processed in, and ten of us were jeeped westward along a dusty road through Dibrugarh and then southward eight miles to a hideaway, a tea garden oasis enveloped by a dense Tropical Rainforest. It was my privilege to sweat out ten days in that upper part of the Valley before going over the Hump to China. This made possible a number of field reconnaissances in the upper part of the Valley and particularly a detailed study of a tea garden.

Results of these field reconnaissances and subsequent research are being prepared for publication. The ten maps compiled from selected statistical, descriptive, graphic, and field sources reproduced on slides accompanying the paper presented at the July 1952 meetings include the following subjects: 1) locational elements; 2) relief map showing the regional boundaries; 3) geology; 4) hydrography; 5) ethnography; 6) minor civil division boundaries and place names; 7) distribution of population and urban centers, 1941; 8) distribution of tea gardens, 1949; 9) transport facilities; and 10) a representative tea garden near Dibrugarh. Significantly, the 500-foot contour appears, as shown on maps 2, 7, 8, and 9, to be a definitive boundary of the region.

College Geography and Community Planning: A Case Study in Applied Geography. ALFRED H. MEYER.

One of the most commonplace and challenging problems in organizing modern school curricula, whether on the elementary, secondary, or college level, is to find an effective way in which geographic education can function academically, professionally, and socially.

This paper proposes to recount experiences which illustrate how such a challenge has been met by projecting an undergraduate college geography curriculum into a program of local community planning. Though specific geographic principles and techniques play a part in this project, the primary objective of this report is to show how academic and public relations values result from effective participation of geography instructors and students in such a project.

The community is Valparaiso, Indiana, a city of some 12,000 population. The planning jurisdictional area includes a two-mile fringe of "rurban" land beyond the city limits. The geography planning participants are staff and student members of the classes in Geographic Planning, Rural Field Survey, Urban Field Survey, and Geographic Problems at Valparaiso University.

Geography instructors and students actively participated in every phase of planning activity—from developing civic interest and intelligence in community planning to collaborating with the city's planning consultant in field surveys, map compilations, and preparation of material for the published Master Plan brochure.

Public interest in city planning was activated by an address on "Geographical

Aspects of Community Planning" based on a large scale map prepared in the department. A departmental staff member served as president of the newly organized Citizens Advisory Planning Council as well as of the City Plan Commission. Another staff member served as assistant to the city planning consultant. Geography students wrote articles on planning with reference to Valparaiso, which were published in the local daily. Students also aided a departmental staff member in the field inventory and map work.

In designing the chief maps of the published brochure, map techniques or compilations were used to emphasize geographic relationships. To present as effectively as possible the principle of geographic correlation of cultural and physical features, as many of the relevant planning data as possible were combined in multiple color on single maps.

In addition to the conventional "zoning" map, geographic "neighborhood" maps were designed with explanatory text material to help stimulate "regional" thinking concerning planning problems on a local neighborhood level as well as on a community level.

The double-page cover map features regional phenomena to impress the Valparaiso citizenry with the idea that the Valparaiso community is geographically a part of a larger community—the Calumet–Chicago region—and that its planning program must therefore be integrated with that of the larger region.

Mathematical Rules and Hinterland Boundaries. HOWARD L. GREEN.

This paper compares hinterland boundaries delimited by mathematical rules with the boundaries defined by functional measures. The hinterlands of New York City and Boston in southern New England are used as an example. The mathematical rules developed by Reilly, Stewart and Zipf are based upon relationships between the populations of cities and the distances separating them.

In the area directly between New York City and Boston, the functional results and the theoretical boundaries are in fairly close agreement. In western Massachusetts, the functional measures give Boston a larger hinterland than do the mathematical rules. In this example, three factors appear to cause the differences between the locations of the functional and mathematical boundaries: 1) New York City and Boston are not strictly comparable; 2) political and administrative boundaries introduce distorting features upon the functional measures; and 3) the uneven distribution of transportation facilities between cities and hinterlands shift the functional boundaries so as to reflect the time-distances between hinterland points and both metropolises.

Similarities in Material Culture: The Texas Llanos and the White River Valley. MERLE PRUNTY, JR.

This discussion is devoted to analysis of physical contrasts, and of cultural-economic similarities indicated by material landscape features, in the Texas Llanos cotton–grain sorghums area and the East Arkansas White River valley. Substan-

tial differences in physical components are noted briefly; certain similarities in the contemporary physical landscapes are cited.

Similarities in such material-cultural features as dominant field crops, field patterns, farm sizes, livestock usage, cultivating and harvesting machinery, irrigation wells, farmsteads and farmstead equipment, fencerows, roads and highways, agricultural use of aircraft, are cited. It is found that the two areas exhibit nearly identical features in certain of the foregoing phenomena, and substantial similarities in the remainder. Other American agricultural areas also are known to exhibit progressively greater similarity in material-cultural landscapes; three suggestions are offered as to the significance of this condition.

First, American mass communication media stimulate dissemination of certain functional concepts regarding land occupance, and one result seems to be that farm organization and operation in diverse areas become more alike. Second, the more widespread functional concepts arise in response to standardized design and mass production of farm machines, farm equipment, roads, wholesaling plants, housing components, etc. The consequence is creation of approximately similar material landscapes in areas which formerly were quite distinct and which had diverse physical origins. Finally, American geographers are confronted with agricultural areas which are becoming progressively more alike and which no longer can be identified satisfactorily by delimitations based upon a single crop or form of land use. Instead the resultant landscapes probably differ from one another mostly in degree of admixture of similar items, not in categories of items; this suggests that new techniques are needed to supply accurate regional differentiations by measuring differences in relative proportional admixtures of about the same landscape components.

Soil Conservation Problems in California as Viewed in Ventura County. HOWARD F. GREGOR.

Ventura County, the southern part of which forms a western outlier of the Los Angeles Lowland, exhibits several significant soil conservation problems in California:

1. *Coastal dune encroachment.* Brisk ocean breezes, longshore currents, and tidal action have combined to form a dune barrier along the coast. Encroachment upon arable land has been partially checked by planting of grass.

2. *Drifting soil.* Aeolian erosion, significant as early as the 1870's, was promoted by a combination of removal of vegetative cover, indiscriminate grazing, and strong winds. Extensive windbreak planting, as well as increased irrigation and more year-around cropping have greatly reduced this type of erosion.

3. *Eroding slopes.* Definite steps have been taken against increasingly serious erosion of the surrounding hills, brought about largely by cultivation, uncontrolled grazing, and fires which have removed the anchoring grass and brush: Reversion to pasture, log and brush dams in gullies, firebreaks on the divides, and—indirectly—terracing on the contour.

4. *Floods.* Although levees have been constructed at strategic places, the flood

problem remains one of the most serious threats to the soil, in terms of both erosion and depositional overlays of worthless sand, gravel, and boulders. Extensive construction of spreading basins, which will not only divert flood water away from intensely used land but will help to replenish record low water supplies in the underground reservoirs, appears to be the major solution.

5. *Poorly drained soils.* Extremely gentle gradients, impermeable clay strata, low rainfall, and warm temperatures have promoted salinity, as well as poor drainage, in much of the area. An extensive system of surface and underground drainways was begun in 1918. The tremendous expansion of land devoted to lemons—a highly salt-sensitive crop—since 1930 evidences the increasing success of the project.

6. *Soil depletion.* Fertilizer consumption has increased several hundred per cent since 1900 as a result of intensified land use. Limited forms of crop rotation have been introduced in field crop areas and cover crops are on the increase in orchard sections.

Some Climatic Variabilities in Iran. EARL E. LACKEY.

Thousands of painstaking patient observers stationed all over the earth keep accurate weather records of temperature, precipitation, wind, humidity, and condition of the sky. Summation of all measures of a given kind are generally expressed in terms of the central tendency (usually the average), and the extremes. The average, as a measure of central tendency, indicates that the chances are approximately 50–50 that half of the measures will be above and half below this computed value. In nearly all of life's ventures we are desperately anxious to forecast more accurately than just our 50–50 (average) chances. Can the record of our weather experience give us better than a 50–50 forecast of our chances as we look to the future? The present study indicates that a forecast of 2 to 1, 10 to 1, or any other chance can be computed with just as much assurance as the even chance (50–50). To demonstrate the practicability of this added use of our weather records this paper will center attention on average monthly temperatures, and average daily maxima and minima temperatures in Iran. For example, the chances according to 31 year record, are 9 to 1 that the average daily minimum temperature in January at Teheran will not fall below 22° F, and that the average daily maximum in July will not rise above 101° F.